
State of California
The Resources Agency
Department of Water Resources

PROJECTED RECREATION USE

FINAL

**R-12
Oroville Facilities Relicensing
FERC Project No. 2100**



MAY 2004

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Department of Water Resources**

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Oroville Facilities Relicensing
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REPORT SUMMARY

This document presents the results of Study R-12 - *Projected Recreation Use*, one of several recreation studies conducted to support the Oroville Facilities Relicensing (Federal Energy Regulatory Commission [FERC] Project No. 2100). This study presents unconstrained projections of potential recreation use in the study area in the future.

INTRODUCTION

This report is divided into seven sections. Section 1.0, Introduction, provides a list of the sites included within the study as well as background information on the Oroville Facilities. Section 2.0, Need for Study, addresses why the study is necessary to support relicensing. Section 3.0, Study Objectives, describes the purpose of the study. Section 4.0, Methodology, discusses the data sources used in this study as well as the procedures used in estimating projected use. Section 5.0, Results and Discussion, describes the results of the study and includes a brief summary of existing use, an explanation of several key variables which may affect future use, and quantitative projections of future use. Section 6.0, Conclusions, describes the conclusions drawn from the results regarding projected use within the study area. Section 7.0, References, lists the information sources and references used for this study.

Lake Oroville is the second-largest reservoir in California, after Shasta Lake. The Oroville Facilities were developed as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, powerplants, and pumping plants that stores and distributes water to supplement the needs of urban and agricultural water users in California. The Oroville Facilities support a variety of recreational opportunities, including several types of boating and fishing, camping, picnicking, swimming, horseback riding, hiking, bicycling, and hunting.

NEED FOR THIS STUDY

This study is needed to comply with FERC regulations, which require estimates of future daytime and overnight recreation use within the study area (Subpart F, 4.51 of 18 Code of Federal Regulations [CFR]).

STUDY OBJECTIVE

The objective of this study is to forecast the amount of recreation use in the study area for various intervals throughout the anticipated license period of the Oroville Facilities. The use projections from this report provide input into other recreation studies.

METHODOLOGY

A review of relevant literature was conducted to provide background information for this study. This information was supplemented with information from other Relicensing Studies, including Study R-14 – *Assessment of Regional Recreation and Barriers to*

Recreation and Study R-9 – Existing Recreation Use. A panel of recreation experts also provided an assessment of recreation trends and lent professional judgment to the study.

Both qualitative and quantitative information were used to project future recreation use within the study area. Statistical models were created to determine the influence of several variables on visitation at Lake Oroville and Thermalito Forebay. Many variables were included in the model, including reservoir level, gas prices, substitute sites, and climactic conditions. Of these, reservoir level was the only variable that was shown to have a statistically significant effect on visitation at Lake Oroville. The Lake Oroville model shows that visitation is somewhat higher when the reservoir level is higher.

Because operations modeling suggested that the reservoir level in 2020 would be similar to current levels, and other variables did not exhibit statistically significant relationships to visitation at Lake Oroville, population growth was the only independent variable remaining in the model to affect future visitation. Therefore, another method was developed which primarily used projection data (Cordell 1999), along with statewide latent demand and past historical trend data to develop projected growth rates for activities prevalent within the Project area. The growth rates were then applied to the baseline use data (from Study R-9 – *Existing Recreation Use*) to calculate unconstrained projected use for each activity at each site.

The relationship that the statistical model showed between visitation and reservoir level allowed the baseline recreation data to be adjusted for the relatively low reservoir pool elevations during the year of baseline data collection (2002–2003). The model predicted that if the reservoir level had been at its 25-year average, recreation use at Lake Oroville sites would have been 9.8 percent higher. Thus, baseline data at Lake Oroville sites was adjusted upwards by 9.8 percent to better reflect average reservoir levels. Sites at other project reservoirs (Thermalito Forebay, Thermalito Afterbay, and Diversion Pool) were not adjusted, because reservoir level variation is minimal at those sites, and data were not available to support development of a statistically-valid relationship between reservoir elevation and visitation at those sites.

Although the Thermalito Forebay model indicated that some visitors chose Thermalito Forebay as a substitute for Lake Oroville when reservoir level was low, the level of significance was marginal. This indicates that visitors may substitute other areas and other activities when Lake Oroville levels are low, but predictive models could not be developed due to lack of historical data.

STUDY RESULTS AND DISCUSSION

Currently, Lake Oroville sites account for just over one-half of the total study area use. The sites with the most use include Bidwell Canyon Boat Ramp (BR)/Day Use Area (DUA)/Marina, Lime Saddle BR/DUA/Marina, Oroville Dam/Overlook DUA, and Lake

Oroville Visitors Center. In terms of activity use, boating and sightseeing account for over 50 percent of total use in the study area.

Variables which may affect future use at the study area are also discussed in qualitative terms. Factors potentially affecting future recreation specifically in the study area include population changes, latent activity demand, and the possible addition of new facilities or special events in the study area. Variables which may influence regional recreation include economic factors, Statewide demand for recreation settings and activities, as well as potential latent demand for facilities (and activities that occur at those facilities) which may result from gaps in the regional supply of recreation facilities. Recreation in general may be affected by several trends identified by the expert panel and literature review, a few of which include population growth, changes in activity preferences, income, and other demographics such as population age.

These qualitative and quantitative variables, along with historical activity participation trends and activity projection data, were incorporated into quantitative projections for study area sites. These projections are unconstrained, meaning that site, facility, social, and ecological constraints are not taken into account as potential factors limiting future use. These projections are also straight-lined, meaning the same percentage growth is used for every projected year. Constraints to future use are addressed in Study R-8 – *Carrying Capacity*. Projections for each decade starting at 2010 and ending at 2050 are presented for sites at Lake Oroville, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, OWA, and additional sites within the FERC boundary, as well as selected sites outside of the FERC boundary. Projections are made in recreation days (RDs). A recreation day is equal to participation in recreation at a site during a single day by one person for any length of time.

According to the unconstrained, straight-line projection, the study area would be expected to receive about 3.5 million RDs by 2050, 97 percent of which are projected to occur within the Project 2100 boundary. This would be a 103 percent increase over 48 years. In general, sites with high amounts of sightseeing and boating use are projected to increase the most over the next 48 years (starting from 2002). Lake Oroville would be expected to remain the dominant area with more than 55 percent of total use in each decade. The OWA would be expected to remain the area contributing the second-highest amount of use with 507,000 RDs (14 percent) by 2050.

Lake Oroville would be expected to receive 2 million RDs by 2050, more than doubling existing recreation use at this area. Several individual recreation sites would be expected to double in use over the next 48 years (assuming no constraints), generally due to high boating and sightseeing use. Between 2010 and 2020, Oroville Dam/Overlook DUA is projected to overcome Bidwell BR/DUA/Marina as the largest contributor to use. In terms of overnight use, Loafer Creek and Bidwell Canyon Campgrounds are forecasted to have the most use of the six campgrounds.

All other project areas would be expected to increase by about 60 to 100 percent or more over the next 48 years. Thermalito Afterbay is forecasted to see the most growth (98 percent) due to large amounts of boating use, where as the OWA is forecast to have the least growth (59 percent) due to lower amounts of boating and sightseeing use, along with expected declines in hunting demand. The Feather River Fish Hatchery would be expected to have visitation double by 2050. Dispersed use is projected to increase moderately compared to individual study area sites. The three sites outside of the FERC boundary would also be expected to have moderately increased use compared to other study area sites.

CONCLUSIONS

The projection of future use in the study area incorporates qualitative factors, activity demand, population growth, and reservoir level to arrive at an unconstrained projection of 3.5 million RDs in 2050. Actual future use will be affected by constraints as described in Study R-8 – *Carrying Capacity*, by unpredictable changes in future demand, and by unquantifiable variables such as those discussed in Section 5.2.3. Due to the many factors affecting visitation, periodic monitoring would be a useful tool to periodically update projections and evaluate trends. A monitoring program would standardize the collection of visitation data and outline how that data would be used to review and revise estimated future use.

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ACRONYMS AND ABBREVIATIONS

af	acre-feet
BIC	Boat-in Campsite
BR	Boat Ramp
CFR	Code of Federal Regulations
cfs	cubic feet per second
DFG	California Department of Fish and Game
DPR	California Department of Parks and Recreation
DUA	Day Use Area
DWR	California Department of Water Resources
FERC	Federal Energy Regulatory Commission
ISO	Independent System Operator
LOSRA	Lake Oroville State Recreation Area
maf	million acre-feet
msl	mean sea level
MW	megawatts
MSA	Metropolitan Statistical Area
NOAA	National Oceanic Atmospheric Administration
NOAA Fisheries	NOAA National Marine Fisheries Service
OHV	Off-Highway Vehicle
OWA	Oroville Wildlife Area
PPV	people-per-vehicle
PWC	Personal Watercraft
RV	Recreational Vehicle
RD	Recreation Day
TA	Trailhead Access
RRMP	Recreation Resource Management Plan
SVRA	State Vehicular Recreation Area
SWP	State Water Project
USACE	U.S. Army Corps of Engineers

1.0 INTRODUCTION

1.1 BACKGROUND

Lake Oroville is the second largest reservoir in California, after Shasta Lake. Existing facilities in the Project area offer a wide variety of recreational opportunities and experiences. Facilities include boat ramps, day use areas, marinas, campgrounds, trails, a visitor center, a shooting range, and an off-highway vehicle (OHV) area. Recreational opportunities include boating, hiking, camping, picnicking, biking, horseback riding, swimming, fishing, hunting, OHV use, and wildlife viewing.

1.1.1 Study Area

The study area encompasses Lake Oroville, and the lands and waters within and adjacent to (within one-quarter mile) the FERC Project 2100 boundary. Sites included in this study are listed in Table 1.1-1 and shown in Figure 1.1-1.

Table 1.1-1. Study area sites.

Lake Oroville	Thermalito Afterbay
Bidwell Canyon BR/DUA/Marina	Wilbur Road BR
Bidwell Canyon Campground	Monument Hill BR/DUA
Loafer Creek BR	Larkin Road Car-Top BR
Loafer Creek DUA	East Hamilton Road TA
Loafer Creek Campground	Thermalito Forebay
Loafer Creek Group Campground	North Thermalito Forebay BR/DUA
Loafer Creek Equestrian Campground	South Thermalito Forebay BR/DUA
Lime Saddle BR/DUA/Marina	Oroville Wildlife Area (OWA)
Lime Saddle Campground	South OWA West Levee Road
Lime Saddle Group Campground	South OWA East Levee Road
Spillway BR/DUA	Thermalito Afterbay Outlet
Oroville Dam/Overlook DUA	Headquarters Entrance
Foreman Creek Car-Top BR	Diversion Pool
Dark Canyon Car-Top BR	Diversion Pool DUA
Vinton Gulch Car-Top BR	Lakeland Boulevard TA
Nelson Bar Car-Top BR	Powerhouse Road TA
Stringtown Car-Top BR	Other
Saddle Dam Trailhead Access (TA)	Feather River Fish Hatchery
Enterprise BR	Riverbend Park
Lake Oroville Visitors Center	Clay Pit SVRA
Bloomer BIC	Rabe Road Shooting Range
Bloomer Knoll BIC	
Bloomer Point BIC	
Bloomer Group BIC	
Craig Saddle BIC	
Foreman Creek BIC	
Goat Ranch BIC	

Source: EDAW 2004.

Note: BR = Boat ramp; DUA = Day Use Area; SVRA = State Vehicular Recreation Area; BIC = Boat-in Campsite.

1.2 DESCRIPTION OF FACILITIES

The Oroville Facilities were developed as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the SWP is to store and distribute water to supplement the needs of urban and agricultural water users in Northern California, the San Francisco Bay area, the San Joaquin Valley, and Southern California. The Oroville Facilities are also operated for flood control and power generation, to improve water quality in the Delta, enhance fish and wildlife, and provide recreation.

FERC Project No. 2100 encompasses 41,100 acres and includes Oroville Dam and Reservoir, three power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and Thermalito Pumping-Generating Plant), Thermalito Diversion Dam, the Feather River Fish Hatchery and Fish Barrier Dam, Thermalito Power Canal, Oroville Wildlife Area (OWA), Thermalito Forebay and Forebay Dam, Thermalito Afterbay and Afterbay Dam, transmission lines, and a relatively large number of recreational facilities. An overview of these facilities is provided in Figure 1.2-1. Oroville Dam, along with two small saddle dams, impounds Lake Oroville, a 3.5-million-acre-foot (maf) capacity storage reservoir with a surface area of 15,810 acres at its maximum normal operating level of 900 feet above mean sea level (msl).

The hydroelectric facilities have a combined licensed generating capacity of approximately 762 megawatts (MW). The Hyatt Pumping-Generating Plant is the largest of the three power plants with a capacity of 645 MW. Water from the six-unit underground power plant (three conventional generating and three pumping-generating units) is discharged through two tunnels into the Feather River just downstream of Oroville Dam. The plant has a generating and pumping flow capacity of 16,950 cubic feet per second (cfs) and 5,610 cfs, respectively. Other generation facilities include the 3-MW Thermalito Diversion Dam Power Plant and the 114-MW Thermalito Pumping-Generating Plant.

The Thermalito Power Canal is a 10,000-foot-long channel designed to convey generating flows of 16,900 cfs to the Thermalito Forebay and pump-back flows to the Hyatt Pumping-Generating Plant. Thermalito Forebay is an off-stream regulating reservoir for the Thermalito Pumping-Generating Plant. The Thermalito Pumping-Generating Plant is designed to operate in tandem with the Hyatt Pumping-Generating Plant and has generating and pump-back flow capacities of 17,400 cfs and 9,120 cfs, respectively. When in generating mode, the Thermalito Pumping-Generating Plant discharges into Thermalito Afterbay, which is contained by a 42,000-foot-long earthfill dam. Thermalito Afterbay is used to release water into the Feather River downstream of the Oroville Facilities, and helps regulate the power system, provides storage for pump-back operations, provides recreational opportunities, and provides local irrigation water. Several local irrigation districts receive Lake Oroville water via Thermalito Afterbay.

Figure 1.1-1. Project Area and Associated Recreation Sites.

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Back of Figure 1.1-1

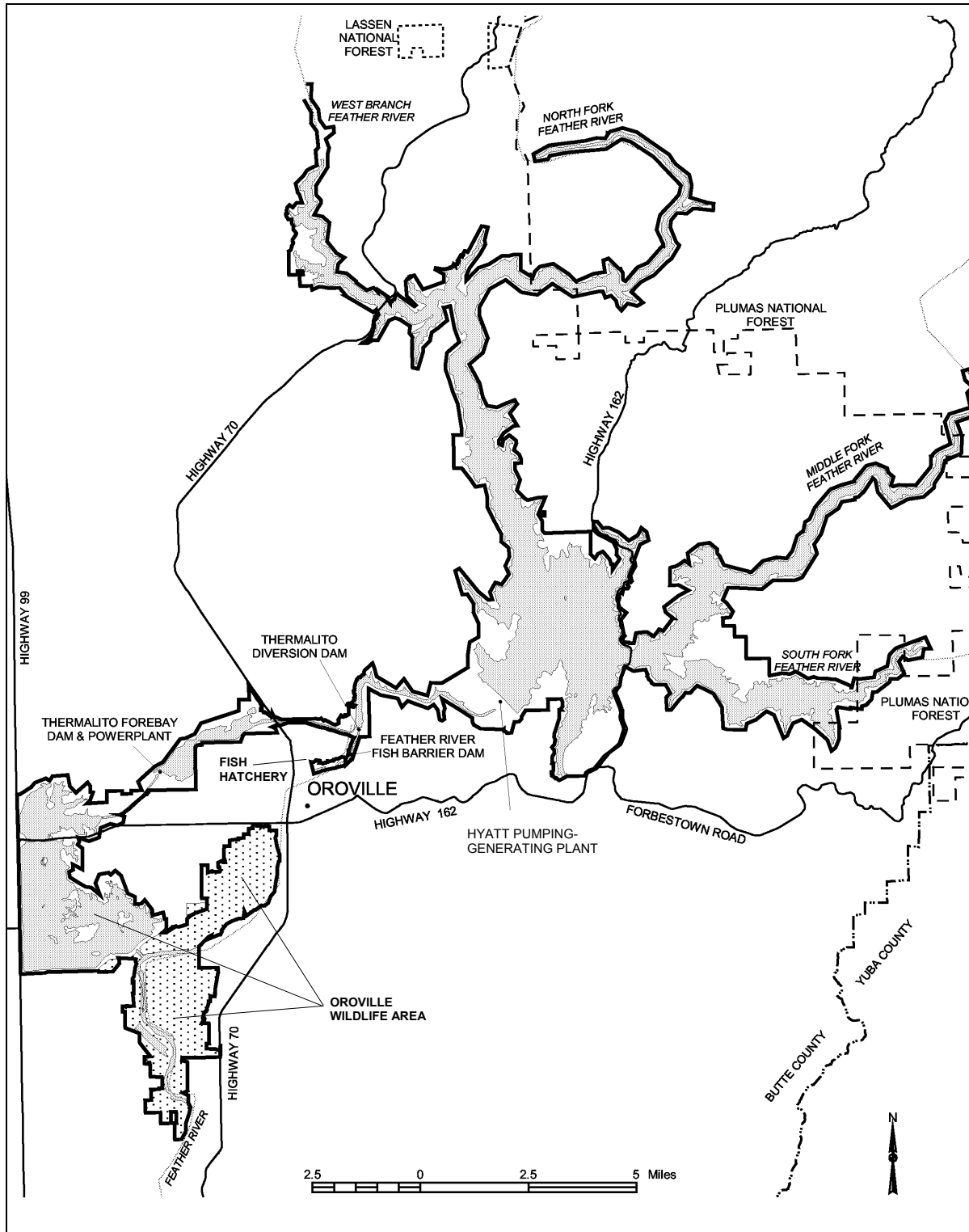


Figure 1.2-1. Oroville Facilities FERC Project 2100 Boundary.

The Fish Barrier Dam is downstream of the Thermalito Diversion Dam and immediately upstream of the Feather River Fish Hatchery. The flow over the dam maintains fish habitat in the low-flow channel of the Feather River between the dam and the Thermalito Afterbay outlet, and provides attraction flow for the hatchery. The hatchery is an anadromous fish hatchery intended to compensate for salmon and steelhead spawning grounds made unreachable by construction of Oroville Dam. Hatchery facilities have a production capacity of 10 million fall-run salmon, 5 million spring-run salmon, and 450,000 steelhead annually (pers. comm., Kastner 2003). However, diseases have occasionally reduced hatchery production in recent years.

The Oroville Facilities support a wide variety of recreational opportunities. These opportunities include boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, and hunting. There are also visitor information sites with cultural and informational displays about the developed facilities and the natural environment. There are major recreation facilities at Loafer Creek, Bidwell Canyon, Spillway, Lime Saddle, and Thermalito Forebay. Lake Oroville has two full-service marinas, five Car-Top boat launch ramps, 10 floating campsites, and seven two-stall floating toilets. There are also recreation facilities at the Lake Oroville Visitors Center, Thermalito Afterbay, and OWA.

The OWA comprises approximately 11,000 acres west of Oroville that is managed for wildlife habitat and recreational activities. It includes Thermalito Afterbay and surrounding lands (approximately 6,000 acres) along with 5,000 acres adjoining the Feather River. The 5,000-acre area is adjacent to or straddles 12 miles of the Feather River, and includes willow- and cottonwood-lined ponds, islands, and channels. Recreation areas include dispersed recreation (hunting, fishing, and bird watching), plus recreation at developed sites, including Monument Hill DUA, model airplane grounds, and three boat launches on Thermalito Afterbay and two on the river, and two primitive camping areas. The California Department of Fish and Game's (DFG) habitat enhancement program includes a wood duck nest-box program and dry-land farming for nesting cover and improved wildlife forage. Limited gravel extraction also occurs in a few locations.

1.3 CURRENT OPERATIONAL CONSTRAINTS

Operation of the Oroville Facilities varies seasonally, weekly, and hourly, depending on hydrology and the objectives that the California Department of Water Resources (DWR) is trying to meet. Typically, releases to the Feather River are managed to conserve water while meeting a variety of water delivery requirements, including flow, temperature, fisheries, diversion, and water quality. Lake Oroville stores winter and spring runoff for release to the Feather River as necessary for project purposes. Meeting the water supply objectives of the SWP has always been the primary consideration for determining Oroville Facilities operation (within the regulatory constraints specified for flood control, in-stream fisheries, and downstream uses).

Power production is scheduled within the boundaries specified by the water operations criteria noted above. Annual operations planning is conducted for multiyear carryover storage. The current methodology is to retain half of the Lake Oroville storage above a specific level for subsequent years. Currently, that level has been established at 1.0 maf; however, this does not limit drawdown of the reservoir below that level. If hydrology is drier or requirements greater than expected, additional water could be released from Lake Oroville. The operations plan is updated regularly to reflect forecast changes in hydrology and downstream operations. Typically, Lake Oroville is filled to its maximum operating level of 900 feet above mean sea level (msl) in June and then lowered as necessary to meet downstream requirements, to a minimum level in December or January (approximately 700 msl). During drier years, the reservoir may be drawn down more and may not fill to desired levels the following spring. Project operations are directly constrained by downstream operational demands and flood management criteria as described below.

1.3.1 Downstream Operation

An August 1983 agreement between DWR and DFG entitled *Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife* (DWR and DFG 1983) sets criteria and objectives for flow and temperatures in the low-flow channel and the reach of the Feather River between Thermalito Afterbay and Verona. This agreement: (1) establishes minimum flows between the Thermalito Afterbay outlet and Verona that vary by water year type; (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period (except for flood management, failures, etc.); (3) requires flow stability during the peak of the fall-run Chinook salmon spawning season; and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the spring/summer for shad and striped bass.

1.3.1.1 In-Stream Flow Requirements

The Oroville Facilities are operated to meet minimum flows in the lower Feather River as established by the 1983 agreement (see above). The agreement specifies that Oroville Facilities release a minimum of 600 cfs into the Feather River from the Thermalito Diversion Dam for fisheries purposes. This is the total volume of flows from the diversion dam outlet, the diversion dam power plant, and the Feather River Fish Hatchery pipeline.

Generally, the in-stream flow requirements below Thermalito Afterbay are 1,700 cfs from October through March, and 1,000 cfs from April through September. However, if runoff for the previous April–July period is less than 1,942,000 acre-feet (i.e., the 1911–1960 mean unimpaired runoff near Oroville), the minimum flow can be reduced to 1,200 cfs from October to February, and 1,000 cfs for March. A maximum flow of 2,500 cfs is not exceeded from October 15 through November 30, to prevent spawning in overbank areas that might later become dewatered.

1.3.1.2 Temperature Requirements

The Diversion Pool provides the water supply for the Feather River Fish Hatchery. The hatchery temperature objectives are 52°F for September, 51°F for October and November, 55°F for December through March, 51°F for April through May 15, 55°F for last half of May, 56°F for June 1–15, 60°F for June 16–August 15, and 58°F for August 16–31. In April through November, a temperature range of plus or minus 4°F is allowed for objectives.

There are several temperature objectives for the Feather River downstream of the Thermalito Afterbay outlet. During the fall months, after September 15, the temperatures must be suitable for fall-run Chinook salmon. From May through August, the temperatures must be suitable for shad, striped bass, and other fish.

National Oceanic and Atmospheric Administration–Fisheries (NOAA Fisheries) has also established an explicit criterion for steelhead trout and spring-run Chinook salmon, memorialized in a biological opinion on the effects of the Central Valley Project and SWP on Central Valley spring-run Chinook and steelhead. As a reasonable and prudent measure, DWR attempts to control water temperature at Feather River mile 61.6 (Robinson's Riffle in the low-flow channel) from June 1 through September 30. This measure attempts to maintain water temperatures less than or equal to 65°F on a daily average. The requirement is not intended to preclude pump-back operations at the Oroville Facilities needed to assist the State of California with supplying energy during periods when the California Independent System Operator (ISO) anticipates a Stage 2 or higher alert.

The hatchery and river water temperature objectives sometimes conflict with temperatures desired by agricultural diverters. Under existing agreements, DWR provides water for the Feather River Service Area contractors. The contractors claim a need for warmer water during spring and summer for rice germination and growth (i.e., minimum 65°F from approximately April through mid-May, and minimum 59°F during the remainder of the growing season), though there is no explicit obligation for DWR to meet the rice water temperature goals. However, to the extent practical, DWR does use its operational flexibility to accommodate the Feather River Service Area contractors' temperature goals.

1.3.1.3 Water Diversions

Monthly irrigation diversions of up to 190,000 acre-feet (af) (July 2002) are made from the Thermalito Complex during the May–August irrigation season. The total annual entitlement of the Butte and Sutter County agricultural users is approximately 1.0 maf. After these local demands are met, flows into the lower Feather River (and outside of the Project 2100 boundary) continue into the Sacramento River and into the Sacramento-San Joaquin Delta. In the northwestern portion of the Delta, water is

pumped into the North Bay Aqueduct. In the south Delta, water is diverted into Clifton Court Forebay where the water is stored until it is pumped into the California Aqueduct.

1.3.1.4 Water Quality

Flows through the Delta are maintained to meet Bay-Delta water quality standards arising from DWR's water rights permits. These standards are designed to meet several water quality objectives such as salinity, Delta outflow, river flows, and export limits. The purpose of these objectives is to attain the highest reasonable water quality, considering all demands being made on the Bay-Delta waters. In particular, they protect a wide range of fish and wildlife including Chinook salmon, Delta smelt, striped bass, and the habitat of estuarine-dependent species.

1.3.2 Flood Management

The Oroville Facilities are an integral component of the flood management system for the Sacramento Valley. During the wintertime, the Oroville Facilities are operated under flood control requirements specified by the U.S. Army Corps of Engineers (USACE). Under these requirements, Lake Oroville is operated to maintain up to 750,000 af of storage space to allow for the capture of significant inflows. Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by the USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with the USACE.

The flood control requirements are an example of multiple use of reservoir space. When flood management space is not required to accomplish flood management objectives, the reservoir space can be used for storing water. From October through March, the maximum allowable storage limit (point at which specific flood release would have to be made) varies from about 2.8 million acre feet (maf) to 3.2 maf to ensure adequate space in Lake Oroville to handle flood flows. The actual encroachment demarcation is based on a wetness index, computed from accumulated basin precipitation. This allows higher levels in the reservoir when the prevailing hydrology is dry. When the wetness index is high in the basin (i.e., high potential runoff from the watershed above Lake Oroville), required flood management space is at its greatest to provide the necessary flood protection. From April through June, the maximum allowable storage limit is increased as the flooding potential decreases, which allows capture of the higher spring flows for use later in the year. During September, the maximum allowable storage decreases again to prepare for the next flood season. During flood events, actual storage may encroach into the flood reservation zone to prevent or minimize downstream flooding along the Feather River.

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2.0 NEED FOR STUDY

FERC licensing regulations require estimates of existing recreation use and future recreation demand within the study area, including both daytime and overnight visitation (Subpart F, Section 4.51 of 18 CFR).

Studying future recreation use is important to help determine how and where to invest in recreation infrastructure and programs. Determining future recreation use requires an evaluation of the variables that influence current recreation use and other variables which may alter people's recreation needs and activities in the future.

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3.0 STUDY OBJECTIVES

The objective of this study is to forecast the amount of potential recreation use in the study area for various intervals throughout the anticipated license period of the Oroville Facilities. The effects of traditional recreation supply and demand variables on future recreation use, as well as those of less clearly defined variables, are considered. The study results will be used in Study R-8 – *Carrying Capacity* to help determine when spatial, facility, social, and ecological carrying capacity may be met or exceeded. Results from Study R-12 will also provide data for Study R-18 – *Recreation Activity, Spending, and Associated Economic Impacts* as well as for Study R-17 – *Recreation Needs Analysis*, which will identify reservoir-based, water-oriented, and other Project-related recreation needs within the study area.

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4.0 METHODOLOGY

This section describes methods used to obtain the results presented in Section 5.0 and Appendices A and B. Projecting future recreation use requires reviewing the effects of many variables that might influence recreation supply and demand. The following outlines the development of the methods used to project recreation use, as well as the specific data sources and various methodology.

4.1 STUDY METHODS

Predicting future recreation demand in the study area nearly 50 years into the future is challenging for several reasons. Numerous variables must be taken into consideration, the magnitude of changes which could occur in the future are unknown, and there is relatively little quantitative data available. Population growth is a useful starting point. Generally, as population increases, demand for recreation increases as a function of population growth. For this study, the review of future population projections began with the projected population growth of each of the 13 counties from which more than one percent of Recreation On-Site Survey respondents originated.

Although population increases are related to increased demand, the demand for recreation is driven by many variables; therefore, more accurate projections of recreation use cannot solely be based on population changes. Statistical models were developed to evaluate the influence of several factors on visitation to sites within the study area where historical data were available: Lake Oroville and Thermalito Forebay. There were no historical data available for Thermalito Afterbay, the OWA, or other areas. Variables were tested for predictive effects, including past visitation trends, income, gas price information, and reservoir level, but reservoir level was the only variable shown to be linked to visitation at Lake Oroville. The model identified a statistically significant positive relationship between Lake Oroville reservoir level and per capita visitation. At Thermalito Forebay, there was a statistically significant positive relationship between the price of gas and visitation, and a negative relationship between Lake Oroville reservoir level and visitation (i.e. as gas prices went up, so did visitation; as Lake Oroville reservoir level went down, visitation to Thermalito Forebay went up). Operational modeling subsequently projected that reservoir level in 2020 would be similar to current levels. With reservoir levels constant, population was the only remaining independent variable, which was considered insufficient to accurately predict future recreation demand.

In order to take the many other independent variables into account, an existing model was reviewed which incorporates many supply and demand variables that could affect recreation use. The model, described in Cordell's *Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends* 1999, reviewed the effects of age, income, ethnicity, sex, and population on growth in specific recreational activities. Significantly, Cordell's model also addressed the availability of recreation resources such as acres of State Park and acres of standing water including lakes, ponds, and

reservoirs. This model projects changes in the number days, trips, and participants in several activities for four different regions within the US. California is included in the Pacific region, along with Oregon, Washington, Hawaii, and Alaska.

Although Cordell's 1999 model takes into account variables predictive of future consumption, it is for a five-state area and thus is not specific to the Project Area, and it does not incorporate some variables which may affect use at the study area such as reservoir level. Because the Lake Oroville statistical model showed that reservoir elevation is linked to visitation, it was felt that modeling results should be incorporated into projections developed for this study. This was done by upwardly adjusting baseline existing use data for Lake Oroville sites to better account for average reservoir elevation.

The method for projecting use in this report takes into account past statewide trend data, study area and regional demand information, population projections, future trends in recreation developed from an expert panel, as well as projection data from Cordell 1999 and statistical Lake Oroville modeling information. The following sections detail information sources and further explain individual components of projected use methodology. It should be noted that the projections are straight-lined, meaning that the same percent growth is used year to year, as well as unconstrained, meaning that site, facility, social, and ecological constraint variables are not taken into consideration. Therefore projections are for recreation demand and may not necessarily correlate to actual use, due to these constraints (and unknown variables) which may limit use in the future.

4.1.1 Data Summary and Review

Many studies were reviewed to support future recreation use forecasts. These background studies were selected because they provide information about the key variables that influence recreation use. Written summaries are provided in Appendix A. Most of these reports were used for qualitative information, however where available, quantitative data from the background reports was used for demand forecasting.

4.1.2 Past Activity Participation Assessment

Past activity participation trends in California based on activity participation as reported in the 1993 and 1998 *Public Opinions and Attitudes on Outdoor Recreation in California* published by California Department of Parks and Recreation (DPR) were reviewed. DFG provided information regarding sales of fishing and hunting licenses, which was also reviewed to determine participation trends in fishing and hunting. A presentation by Green, Cordell, and Betz (2003a) also supplied trend information for many activities in California based on the 1995 and 2001 National Recreation Survey.

4.1.3 Existing Use Data

As part of Study R-9 – *Existing Recreation Use*, recreation days (RDs) have been estimated for all sites within the study area by compiling several sources of visitation data including DWR traffic counters, DPR traffic counters, DPR campground data, and survey and observational data. One RD represents participation in recreation at a site during a single day by one person for any length of time. To calculate RDs at sites with traffic counters, the total daily number of vehicles was multiplied by average people-per-vehicle (PPV). PPV was estimated based on traffic counter calibration observations made at each counter and could vary between the recreation season and the off-season and weekdays and weekends. To calculate RDs at campgrounds, the number of campsites occupied was multiplied by the average number of campers per site, which was derived from campers' Recreation On-Site Survey responses (see Study R-13 – *Recreation Surveys* for survey methodology). At sites where there were no traffic counters or the data from traffic counters were unusable, observational data was used to develop a total daily vehicle count which was multiplied by PPV to estimate the daily number of RDs. The amount of use at study area sites by activity has also been estimated. Observational data about the number of people participating in each activity and the number of vehicles with boat trailers (representing boaters who were generally not on-site to be counted), were reviewed to estimate the percentage use at each site for each activity. These percentages were then multiplied by the total RDs for each site to obtain total RDs per activity. The estimates of use by activity were used as baseline data from which forecasts of use within the study area were calculated.

4.1.4 Statistical Demand Forecasting

A set of recreation use models was developed as a tool to assist in forecasting future recreation use at the Oroville Facilities. Based on the availability of data, separate models were developed for Lake Oroville and Thermalito Forebay. Historical data were not available to provide a basis for modeling the other geographical areas within the study area. The regression-based models quantitatively describe the relationship between attendance levels (i.e., recreation use) in the Project area and a range of physical and social factors that potentially influence recreation use levels.

Annual and monthly recreation use models were developed as part of this effort. The annual models developed for Lake Oroville and Thermalito Forebay are based on the fiscal-year calendar (July through June), which corresponds to the attendance data collected by DPR and DWR. Subsequently, a monthly model was also developed (for Lake Oroville only) based on selected peak-season months and recreation sites that have been identified by DWR as supplying more reliable data.

4.1.4.1 Development of Recreation Visitation Models

A summary of the methodology used to develop the annual and monthly recreation visitation models is presented below; a complete description of the development of

these models is included in Appendix B of this report. This model development can be organized into eight tasks as follows:

Task 1: Assemble and Review Attendance Data.

Estimated recreation use at Lake Oroville and Thermalito Forebay using regression models was based on statistical analysis of historical (time series) data. The key variable of interest was the level of attendance at project facilities, which was considered the dependent variable in the model. Several sources of attendance data for Lake Oroville were reviewed, and it was concluded that the best data source was DWR official estimates for the period from 1974/75 to 2000/01.

Task 2: Assess Potential Models to Fit the Attendance Data.

A range of potential model types, varying in source and structure of the attendance data, were evaluated to identify the model that would best explain changes in recreation use over time at the Oroville Facilities. Three potential model types were considered: (1) monthly/seasonal; (2) annual (calendar year); and (3) annual (fiscal year). The annual (calendar year) model type was chosen because it aligns with DWR's annual data. DWR provides the most extensive, complete, and current data set available, and it provides information by park unit. For the annual (fiscal year) model, two attendance variables were created: (1) Oroville fiscal year attendance at all recreation sites, excluding the North and South Forebay and the Clay Pit State Vehicular Recreation Area (SVRA), and (2) Oroville fiscal-year attendance at all recreation sites, excluding the North and South Forebay and the Clay Pit SVRA area, on a per capita basis. A weighted population factor based on visitor origin obtained from visitor surveys was used to derive the per capita estimates of use.

Task 3: Assemble Data for Explanatory Variables.

The explanatory or independent variables in the regression model are intended to represent major factors that influence attendance at Lake Oroville and Thermalito Forebay. The selection of explanatory variables was based on a review of other recreation use models, knowledge about the project area, and availability of data. Seven general categories of explanatory variables were considered in the development of the model: (1) reservoir level conditions; (2) substitute sites; (3) demographics; (4) economic conditions; (5) travel cost; (6) climate; and (7) recreation trends.

Task 4: Conduct Regression Analysis to Identify a Base Model.

Regression analysis using statistical software was used to identify a base recreation model for Lake Oroville. The base model represents the core dependent and independent variables that are critical to the model, both in terms of modeling efficiency and in being able to evaluate the effects of changes in resource conditions on recreation use in the project area. The base model also identifies the most appropriate functional form of the regression equation. In summary, the base model for Lake Oroville and Thermalito Forebay are characterized by the following attributes:

Functional Form: Linear-log.

Dependent Variable(s): Per-capita attendance at Lake Oroville/Forebay.

- Independent Variables: (1) Year of observation, and (2) Oroville average annual fiscal year lake elevation (based on monthly averages).

Task 5: Test Alternative Variables with Base Model to Improve Model Fit.

After the base model(s) were identified, additional variables were added to the base set of explanatory variables to determine whether they improved the robustness of the model, as measured by statistical significance of coefficient estimates and increase the explanatory power (R-squared) of the model. This process indicated that the travel cost variable (i.e., gas prices) was appropriate for inclusion in the Thermalito Forebay model. The other sets of variables, including substitute sites, economic indicators, and climate conditions, either did not improve the fit of the base models or did not meet the significance criterion, and thus were not included in the expanded base model.

Task 6: Test Temporal Consistency of the Data.

Based on a review of the recreation attendance data and the results of preliminary modeling efforts, it was concluded that the recreation model may be affected by temporal inconsistency. Temporal inconsistency refers to a model with parameters (both the coefficients and error term) that vary across observations of the sample. In other words, different sub-samples of the dataset (in this case, different time periods) produce significantly different results in terms of coefficient estimates and precision of the model. Because there is no one event that serves as rationale for temporal inconsistency in the Lake Oroville and Thermalito Forebay models, structural break tests were conducted over a range of potential break points using the Chow test statistic. The results of the Chow tests indicated that there are significant structural breaks in both the Oroville and Forebay models. The strongest break in the Oroville model occurs between fiscal years 1980–81 and 1981–82, while the strongest break in the Thermalito Forebay model occurs a year earlier between 1979–80 and 1980–81. To address the issue of temporal inconsistency in the models, dummy and interactive variables were created using the location of the strongest breaks in the dataset.

Task 7: Select a Set of Expanded Models and a Preferred Model.

The selection of a set of expanded recreation visitation models was based on several criteria that gauge the robustness of the models. This set of models was evaluated in the context of three main criteria: (1) adjusted R-square, (2) p-values, and (3) multicollinearity. To select the preferred models, the predictive capability of the expanded models was analyzed. Comparison of predicted and actual values associated with model alternatives, allows the predictive capability of the model to be gauged, as well as revealing the presence of any systematic patterns in the predictive model (e.g., over-predicting and/or under-predicting attendance levels based on type of water year).

Task 8: Perform Diagnostic Tests for Autocorrelation in the Preferred Model and Develop Corrections, as Necessary.

The final step in the development of the annual recreation models was to ensure statistical credibility of the models through the use of diagnostic tests checking for autocorrelation. Autocorrelation arises when the residual error term in one time period is positively correlated with the residual error term in another time period. The presence of first-order autocorrelation is tested using the Durbin-Watson statistic. Based on the significance points (5 percent level of significance) associated with the Durbin-Watson statistic for the models, one cannot conclude that there is autocorrelation in either of the models, and as such, there was no need to correct for this problem through the use of variable transformations.

4.1.4.2 Use of the Recreation Visitation Models

While the recreation visitation models represent an important tool in forecasting future recreation use at the Oroville Facilities, they have not been directly used to project recreation use at Lake Oroville and Thermalito Forebay. The recreation models were not used in this manner because the preliminary results of the operations modeling conducted to assist in relicensing the project indicate that more factors must be considered than were valid in the recreation visitation models. Specifically, the operations modeling forecasted reservoir levels at Lake Oroville for 2020 based primarily on anticipated water demands and existing commitments. The preliminary results of the operations modeling indicate that there is not expected to be a significant change in reservoir levels at Lake Oroville in 2020 relative to baseline (2001) conditions. As a result, the recreation use models, which are driven predominantly by the relationship between lake levels and recreation use, are not particularly applicable. Therefore, an alternative methodology was developed to predict recreation use through 2050 as described in Section 4.1.5 Use Projections Based on Activity.

Although the recreation visitation model was determined to be insufficient for projecting future use, it is nevertheless a useful tool for anticipating the effects of water level on visitation. Because projections are based on existing use information that was collected in a year with relatively low water conditions, the annual Lake Oroville model was used to calculate what existing use in recreation days (RDs) would be in a year with reservoir levels at the 25-year average. The model predicted that if the reservoir had been at its average (calculated over the last 25 years), the baseline number of RDs at Lake Oroville sites would have been 9.8 percent higher. The baseline existing use data was thereby adjusted to reflect recreation use under more average water level conditions.

The recreation attendance model for Thermalito Forebay indicated that low pool levels at Lake Oroville can positively affect recreation attendance at Thermalito Forebay. The explanation for this effect is that as lower water levels drive visitors away from Lake Oroville they may choose to recreate at Thermalito Forebay. Thus, Thermalito Forebay could serve as a substitute site for some activities, in particular swimming, bank fishing, and picnicking. However, while the overall model explained roughly 68 percent of the

annual variability in attendance at Thermalito Forebay, Lake Oroville elevation accounted for relatively little (less than 3 percent) of that explained variability. In comparison, gasoline price accounted for about 45 percent, and a time trend variable accounted for about 20 percent. There may also be some degree of substitution occurring at Thermalito Afterbay, Diversion Pool, or the OWA, but there are no models for these areas due to a lack of historical data. People may also choose to participate in different activities when the reservoir is low; however, data on this subject are insufficient for analysis.

4.1.5 Use Projections Based on Activity

Due to lack of historical activity data in the statistical models, they are based on less specific and potentially less predictive data than projections of use based on current activity participation. Therefore, projected future use is based on current use by activity and the projected growth in those activities. These use projections are straight-line projections, meaning annual growth is assumed to be constant over the term of the projection. The projection is also unconstrained, meaning spatial, facility, social, and ecological constraints are not accounted for in the projections. Where appropriate, Study R-8 – *Carrying Capacity* will apply capacity information to the unconstrained projections presented in this report to determine constraint factors and when and if capacity will be met.

First, the future participation and demand activities listed in Study R-9 – *Existing Recreation Use* were investigated. This was based on activity projections developed in *Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends* by Cordell (1999), the only appropriate future projection data source available. The model used in this study reviewed variables including age, income, ethnicity, sex, population, as well as many variables that take into account the availability of recreation resources such as acres of State Park area and acres of standing water including lakes, ponds and reservoirs. Results of the Cordell model included changes by decade to the number of days, trips, and people participating in several activities. The annual change in activity participation and days were calculated based on the projected index numbers for the Pacific region, which includes Alaska, Hawaii, Washington, Oregon, and California. These annual changes, along with DPR information on latent demand (found in DPR 1998), are compiled into Table 4.1-1.

This information, along with projected increases in the populations of predominant visitor-origin counties, expert judgment on future trends in recreation activities, and past activity participation were used to develop preliminary annual demand percentages for each activity. These individual activity projection percentages were then grouped into similar ranges. Each group was then assigned a discrete percent best representing that group's expected rate of future growth (demand). These demand categories included: decline, low demand, moderate demand, and high demand.

Table 4.1-1. Projected annual percent change in participation, annual days, and latent demand for study area activities.

Activity	Annual change in number of annual days ¹ (percent)	Annual change in participation ¹ (percent)	Latent Demand
Bank fishing	0.67	0.58	High
Boating	2.07	1.15	Low
Camping	1.15	1.00	High
Sightseeing	1.75	1.15	Low
Hunting	-0.38	-0.81	Low
Picnicking	0.88	0.89	High
Swimming	0.81	0.99	High
Hiking	0.88	1.12	High
Biking	0.80	0.91	Low
Horseback riding	0.97	1.04	Moderate
Off-road driving	0.64	0.52	Low
Walking	0.95	1.00	High
Target shooting	NA	NA	Low

¹ For the Pacific region which includes California, Oregon, Washington, Alaska, and Hawaii.

Sources: Cordell 1999, DPR 1998.

Categories were developed because the level of accuracy and variation in the data did not justify discrete percentages for each activity. Therefore, activities within the same category could be expected to have very similar rates of future demand, and were thus assigned the same rate of growth. Boat fishing was treated as a separate activity from boating because boating was categorized as a high future demand activity and fishing as a low future demand activity. The activities and their categorization are listed in Table 4.1-2.

The estimated annual change in demand (in percent) for each category are listed in Table 4.1-3. Projected use was calculated by multiplying the projected annual change in demand for each activity to the number of baseline RDs (as adapted from the *Existing Recreation Use* report), and compounding the growth over 48 years. Projected use was calculated for each activity at each site.

Table 4.1-2. Future activity demand in the study area.

Activity	Demand Category
Bank fishing (& boat fishing)	Low
Boating	High
Camping	Moderate
Sightseeing	High
Hunting	Declining
Picnicking	Moderate
Swimming	Moderate
Hiking	High
Biking	Moderate
Horseback riding	Moderate
Off-road driving	Low
Walking	High
Target Shooting	Low

Source: EDAW 2004.

Table 4.1-3. Annual change in demand per category.

Demand Category	Annual change in demand (percent)
Declining	-0.4
Low	0.7
Moderate	1.1
High	1.8

Source: EDAW 2004.

Activity projections at Lake Oroville sites were adjusted to reflect average water conditions because the statistical model showed that visitation at Lake Oroville has a relationship to reservoir level. Baseline recreation participation by activity was based on observations under relatively low water conditions; therefore, it was felt that projections for activities at Lake Oroville sites should be adjusted upwards to reflect participation levels typical of average water conditions. The model was used to compare actual visitation during 2002 low water conditions to visitation using a 25-year average reservoir elevation. The 9.8 percent difference in visitation was used as an adjustment factor for Lake Oroville sites (those directly affected by changes in reservoir level). Thus, the Lake Oroville 2002–03 baseline activity use data (from Study R-9) were adjusted, and then the annual percent change in demand (from Table 4.1-3) was applied to that adjusted base.

All study area sites are included in the projections except for the BICs and floating campsites. Boating activity is actually measured as boating access, and therefore these boating dependent sites are assumed to be accounted for under the boating activity and attributed to the boating access sites. Recreation On-Site Survey data were used to make broad estimates as to the amount of different types of trail use at the TA's and the Diversion Pool DUA (see Study R-13 – *Recreation Surveys* for a description of survey methodology). The amount of “other” activities (typically walking) at each site was estimated from observation data and these activities were used in projections. If it was not possible to determine “other” use, the stated activity percentages were re-calculated to exclude “other” use.

4.1.6 Regional Recreation Opportunities Assessment

Study R-14 – *Assessment of Regional Recreation and Barriers to Recreation* was used to help forecast use at the study area. Statewide latent demand, support for public funding for various activities, recreation setting preference, and sales of fishing and hunting licenses were reviewed. Regional demand and supply information were also reviewed to better identify activities that may have potential for future growth within the study area. Survey data reporting demand for new activities and facilities were also reviewed. The Phase 1 Background Report on Economic and Fiscal Conditions was reviewed for regional economic information (TCW Economics 2003).

4.1.7 Expert Judgment Approach

The expert judgment approach is a methodology for gaining qualitative input from those persons most closely involved in a particular resource sector—in this case, recreation—and a specific project. Quantitative methods do not always capture the complete picture for a given activity or resource area; therefore, a qualitative method is needed (Walsh 1986). A panel of experts with recreation research and planning knowledge and familiarity with the study area and region was convened to provide an assessment of future trends in outdoor recreation and how they may affect study area visitation. The panel consisted of recreation experts from EDAW, Inc. and TCW Economics, and included the following participants:

Charles Everett: Twenty years of experience in recreation research and management including 15 years of river-specific research and 13 previous FERC relicensing efforts in the western U.S.

Steve Nachtman: Twenty-five years of experience in various aspects of recreation and consumer research, environmental impact assessment, and the procedures involved in FERC hydroelectric project relicensing.

Tom Wegge: Twenty years experience in conducting recreation demand analysis, evaluating recreation trends, and estimating outdoor recreation use;

Steve Pavich: Eight years of experience in resource economics, applied quantitative analysis, and socioeconomic and social science research.

Jim Vogel: Ten years of experience in natural resource management and outdoor recreation planning including the application of survey research methods, management information systems, and public involvement techniques to improve the management of lands and waters for recreation.

Sergio Capozzi: Six years of experience in various aspects of recreation research and management, quantitative and qualitative data collection approaches, and four previous FERC relicensing efforts in the western U.S.

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5.0 STUDY RESULTS

This section summarizes the qualitative and quantitative results of Study R-12 – *Projected Recreation Use*. Current recreation participation data provide the baseline for future use projections. The availability of regional recreation opportunities and settings, the amount of latent activity demand, and future demographic changes will affect the future recreation use and demand within the study area. Quantitative straight-lined unconstrained projections of use by decade until 2050 are presented and reflect future recreation demand and not necessarily actual future use. Future use will be affected by spatial, facility, social, and ecological constraints (presented in Study R-8 – *Carrying Capacity*); future use may also be influenced by unpredictable future events that will ultimately determine what use will be accommodated within the study area.

5.1 EXISTING RECREATION USE

Existing recreation use (2002–03) provides the baseline for projected use in the study area. Visitation and activity use is derived from Study R-9 – *Existing Recreation Use* and includes the entire study area. Existing recreation use by activity and area is summarized in the following section. While modeling data were used to upwardly adjust the existing use data (due to low reservoir levels) for projection purposes, unadjusted (actual) data are presented in this section.

5.1.1 Visitation

Relicensing Study R-9 – *Existing Recreation Use* estimated use for both weekdays and weekends for the recreation season and the off-season. The recreation season was from May 15, 2002, to September 15, 2002. The off-season was from September 16, 2002 to May 14, 2003. Visitation was reported in the form of recreation days (RDs). A recreation day consists of a visit by one person to a recreation area for any portion of a single day. It is important to note that visitation at several Lake Oroville sites was probably affected by low water conditions on the reservoir during much of the 2002 recreation season. The reservoir elevation was approximately 20–50 feet below the 12-year average (1990–2001) through most of the recreation season when data was collected.

There were a total of about 1.73 million RDs in the study area between May 15, 2002, and May 14, 2003 (Table 5.1-1). Use was split between the 4-month recreation season and the 8-month off-season; 56 percent of use occurred in the recreation season (960,000 RDs) and 44 percent of use occurred in the off-season (768,000 RDs). Table 5.1-1 lists the geographic areas within the study area and the total visitation at each area.

The sites that contributed the most to total use were the Bidwell Canyon BR/DUA/Marina, Lime Saddle BR/DUA/Marina, and Oroville Dam/Overlook DUA. These three sites accounted for about 30 percent of the total use in the study area and about 60 percent of the use at Lake Oroville. Bidwell Canyon BR/DUA/Marina and Lime

Saddle BR/DUA/Marina contributed more use in the 4-month recreation season than in the 8-month off-season; the opposite was true for Oroville Dam/Overlook DUA. The Lake Oroville Visitors Center had twice as much use in the off-season as in the recreation season; as a result, this site was the third-most-used Lake Oroville site. Lime Saddle BR/DUA/Marina had about one-half the use in the off-season that it had in the recreation season. Generally, at similar reservoir-based recreation areas, 70 percent or more of the total use occurs during the recreation season (pers. comm., Wegge 2003). However, the Oroville Facilities are very close to the cities of Oroville, Chico, and Paradise and therefore receive a substantial amount of local use year-round.

Table 5.1-1. Visitation (recreation days) in the Oroville Facilities study area.¹

Area	Recreation Season Total	Off-season Total	Combined Seasons Total
Lake Oroville	518,472	392,711	911,183
Bidwell Canyon Complex	133,365	84,344	217,709
Loafer Creek Complex	63,741	25,803	89,544
Lime Saddle Complex	113,036	49,184	162,220
Diversion Pool	7,055	13,548	20,603
Thermalito Forebay	78,237	57,483	135,720
Thermalito Afterbay	61,834	31,534	93,368
Oroville Wildlife Area	191,118	127,344	318,462
Additional Sites within FERC Boundary	72,930	106,275	179,205
Feather River Fish Hatchery	65,890	94,505	160,395
Dispersed Use Sites ²	7,040	11,770	18,810
Additional Sites Outside FERC Boundary	30,128	39,017	69,145
Total for Study Area	959,774	767,912	1,727,686

¹ These calculated values are rounded when reported in the text to avoid conveying unwarranted precision.

² Dispersed sites include: Old Nelson Bar, Parrish Cove, Nelson Avenue Bridge over Thermalito Forebay, Highway 162 Overlook, Canyon Creek Bridge, South Wilbur Road TA, Tres Vias Road TA, and Toland Road TA. Also included in these totals are "other dispersed use sites" which includes any dispersed use occurring within the study area at sites other than those that are known dispersed sites.

Sources: DPR 2003; DWR 2003a; EDAW 2004a.

Table 5.1-2 shows how the different Project areas rank in contribution to total use, recreation season use, and off-season use. Sites around Lake Oroville account for slightly more than one-half of the total use in the study area. The OWA is the second-highest use area, with about 18 percent of the total combined-season use in the study area. The Feather River Fish Hatchery is the third largest contributor in the off-season and in total combined-season use, however this site is fourth in use during the recreation season. This site received a substantial amount of off-season sightseeing use from both individual visitors and tour groups, especially during salmon runs. The Thermalito Forebay contributed about eight percent of the total combined season use in

the study area, ranking it fourth (third in the recreation season). About five percent of the total combined season use was at the Thermalito Afterbay, ranking this area as the fifth-largest contributing area. The additional sites outside of the FERC boundary (Riverbend Park, Clay Pit SVRA, and Rabe Road Shooting Range) ranked sixth, with four percent of the combined season use. The Diversion Pool and dispersed use sites only contributed about one percent each to use within the study area, and thus rank seventh and eighth (respectively) out of the eight geographic areas.

Table 5.1-2. Ranking of geographical areas by percent contribution to existing use.

Ranking	Percent Contribution		
	Combined Season Use	Recreation Season	Off-season Use
1. Lake Oroville	52.7	54.0	51.1
2. OWA	18.4	19.9	16.6
3. Feather River Fish Hatchery ¹	9.3	6.9	12.3
4. Thermalito Forebay	7.9	8.2	7.5
5. Thermalito Afterbay	5.4	6.4	4.1
6. Additional sites outside FERC boundary ²	4.0	3.1	5.1
7. Diversion Pool	1.2	0.7	1.8
8. Dispersed use	1.1	0.7	1.5

¹ In the recreation season, this site is ranked fourth.

² In the off-season, the total for these sites is ranked fifth.

Sources: DPR 2003; DWR 2003a; EDAW 2004.

5.1.2 Activity Use

Table 5.1-3 lists the activities observed in Study R-9 – *Existing Recreation Use*, ranked by their percent contribution to total use in the study area. Boating access¹ and sightseeing combined comprise over 50 percent of the total use in the study area, with 29 and 26 percent of use, respectively. Boating was the most popular activity in the study area, and includes boat fishing, personal watercraft (PWC) use, motorboating, houseboating, and water-skiing. There are boat ramps at 17 of the 39 recreation sites, and a few other sites have undeveloped boat ramps. These facilities provide boating access at every part of the study area.

Sightseeing, the second most popular activity, was also participated in at every geographical area within the study boundary. However, it was at sites such as the Lake Oroville Visitors Center, Oroville Dam/Overlook DUA, and the Feather River Fish Hatchery (where sightseeing is the main use) that this activity had the highest proportion of RDs.

¹ The term “boating access” is used because boating activities do not literally occur at the site; the site provides access for boaters to the body of water where boating activities take place.

Bank fishing was the third most popular activity within the study area, with over 300,000 RDs. Bank fishing was especially popular at the car-top boat ramps and in the OWA. Picnicking contributed about nine percent to total use within the study area, ranking it fourth of the nine activities. "Other" had a high number of RDs due to the large amount of site-specific use that did not fit into existing categories of activities, and includes shooting, frisbee golf, walking, biking, and OHV use. Swimming, the sixth most popular activity with slightly more than 100,000 RDs, occurred mostly at the Loafer Creek DUA (on Lake Oroville) and at North Thermalito Forebay BR/DUA (on the Thermalito Forebay). Camping accounted for about four percent of the total use in the study area with about 60,000 RDs. Trail use and hunting both had low contributions to total use with about one percent each.

Table 5.1-3. Ranking of activities in the study area based on percent contribution to total use.

Activity	Contribution to Total Use in Study Area (percent)	Number of RDs
1. Boating (access) ¹	29.2	504,458
2. Sightseeing	25.6	442,142
3. Bank fishing	18.3	316,192
4. Picnicking	9.1	158,030
5. Other	6.6	113,180
6. Swimming	5.9	101,500
7. Camping	3.6	62,339
8. Trail Use	0.9	15,984
9. Hunting	0.8	13,861
Total	100	1,727,686

¹ The term boating access is used because boating activities do not literally occur at the site; the site provides access for boaters to the body of water where boating activities take place.

Sources: DPR 2003; DWR 2003a; EDAW 2004.

Table 5.1-4 lists all study area sites and the activities that occurred at each site. These activities provide the basis for the activity projections for each site. At some sites, some low-use activities were not measurable; therefore, these activities were not included in recreation projections (shown as "n/a" in Table 5.1-4).

Table 5.1-4. Activity use at study area sites.

Site	Boating Access	Sightseeing	Bank Fishing	Picnicking	Swimming	Camping	Trail use	Hunting	Other
Lake Oroville Sites									
Bidwell Canyon BR/DUA/Marina	X	X	X	X	X				
Bidwell Canyon Campground						X			
Loafer Creek BR	X								
Loafer Creek DUA		X	X	X	X				
Loafer Creek Campground						X			
Loafer Creek Group Campground						X			
Loafer Creek Equestrian Campground						X			
Lime Saddle Campground						X			
Lime Saddle Group Campground						X			
Lime Saddle BR/DUA/Marina	X		X	X					
Spillway BR/DUA	X	X		X	X	X			
Oroville Dam/Overlook DUA		X	X	X					X
Foreman Creek Car-Top BR	X	X	X	X	X				
Dark Canyon Car-Top BR	X	X	X	X	X				
Vinton Gulch Car-Top BR	X	X	X	X	X				
Nelson Bar Car-Top BR	X	X	X	X	X				
Stringtown Car-Top BR	X	X	X	X	X				
Saddle Dam TA							X		
Enterprise BR	X	X	X	X	X				
Lake Oroville Visitors Center		X							
Diversion Pool Sites									
Diversion Pool DUA	X	X	X	X	n/a		X		
Lakeland Boulevard TA							X		n/a
Powerhouse TA							X		n/a
Thermalito Forebay Sites									
North Thermalito Forebay BR/DUA	X	X	X	X	X	X	n/a		X
South Thermalito Forebay BR/DUA	X	X	X	X	X				

Table 5.1-4 (continued). Activity use at study area sites.

Site	Boating Access	Sightseeing	Bank Fishing	Picnicking	Swimming	Camping	Trail use	Hunting	Other
Thermalito Afterbay Sites									
Wilbur Road BR	X							n/a	
Monument Hill BR/DUA	X	X	X	X	X			n/a	n/a
Larkin Road Car-Top BR	X	X	X	X	X			n/a	n/a
East Hamilton Road TA							X	n/a	
Oroville Wildlife Area Sites									
South OWA West Levee Road	X	X	X	X	X	n/a		X	n/a
South OWA East Levee Road		X	X	X	X			X	n/a
Thermalito Afterbay Outlet	X	X	X	X		n/a	n/a		n/a
Headquarters Entrance	X	X	X	X	X		n/a	n/a	n/a
Additional Sites within the FERC boundary									
Feather River Fish Hatchery		X		X					
Dispersed Use Sites	n/a	X	X	X	X		n/a	X	X
Other dispersed use sites		X	X	X	X				X
Additional Sites outside the FERC boundary									
Riverbend Park	X	X	X	X	X		n/a		X
Clay Pit SVRA									X
Rabe Road Shooting Range									X

Note: Dispersed sites include Old Nelson Bar, Parrish Cove, Nelson Avenue Bridge over Thermalito Forebay, Highway 162 Overlook, Canyon Creek Bridge, South Wilbur Road TA, Tres Vias Road TA, and Toland Road TA. "Other dispersed use sites" includes any dispersed use occurring within the study area at sites other than those that are known dispersed sites (which are listed under dispersed use sites). "n/a" means that although this activity occurs at the site, the amount of use is unquantifiable

Sources: DPR 2003; DWR 2003a; EDAW 2004.

5.2 VARIABLES AFFECTING FUTURE USE

Future use within the study area could be affected by many variables, many of which are discussed in this section, although unforeseen events or conditions in the future could also affect use. The following information, although qualitative, was taken into consideration when making quantitative use projections. Variables discussed begin at the local level (study area) and expand to the region and more general trends in recreation.

5.2.1 Study Area Variables

Within the study area, there are some variables which may lead to changes in activity participation and therefore affect future visitation levels. These variables include changes in population, unmet (or latent) demand for certain activities, and the possibility of new facilities or special events being offered in the study area in the future.

5.2.1.1 Changes in Population

Visitor origin can be extrapolated from Recreation Visitor On-Site Survey respondents' county of primary residence (based on primary residence zip code information). According to the survey, over 50 percent of respondents were from Butte County. The county with the second-largest number of respondents was Sacramento County, with about six percent of respondents. Generally, respondents were from around the study area, the Sacramento area, or the San Francisco Bay area. All of the counties with over one percent of respondents are listed in Table 5.2-1. There were several other counties listed in the survey; however, they had one percent or less of respondents and therefore are not included in Table 5.2-1. The top 13 counties account for about 86 percent of Recreation Visitor On-Site Survey respondents.

Table 5.2-1. Recreation Visitor On-Site Survey respondents' county of primary residence (top 13 counties).

County	Percent of Respondents	County	Percent of Respondents
1. Butte	53.5	8. Santa Clara	2.2
2. Sacramento	5.7	9. Alameda	2.1
3. Sutter	5.3	10. Sonoma	1.4
4. Placer	3.8	11. Yolo	1.2
5. Contra Costa	3.2	12. San Joaquin	1.1
6. Yuba	2.8	13. San Mateo	1.1
7. Solano	2.5		

Note: There were several other counties listed, but were listed by 1 percent or less of respondents.

Source: EDAW 2003a (Recreation Visitor On-Site Survey).

According to population projections for these counties, all of them are expected to grow over the next 40 years, many by over 10 percent per decade (Table 5.2-2), and some up to 20 percent per decade.

With a growing pool of potential visitors in these counties, demand for recreation at the study area could increase. It is likely that the projected increase in the population of Butte County (15 to 20 percent per decade) may result in an increase in day use. Overnight visitation may not increase as much due to lower population increases in counties further away such as Contra Costa, Alameda, and San Mateo, where more overnight visitors would likely originate. However, historical data show that although the populations of Butte County and the entire State of California have increased over the last 30 years, visitation at Lake Oroville has not increased (see R-14 – *Assessment of Regional Recreation and Barriers to Recreation*, Section 5.2.1: Existing and Past Attendance, for more detailed information).

Table 5.2-2. Projected increases in county populations by decade.

County	Percent increase from the previous decade				Average annual percent increase
	2010 ¹	2020 ¹	2030 ²	2040 ²	
Butte	26.5	18.9	17.5	15.6	1.80
Sacramento	19.7	14.9	10.3	12.7	1.35
Sutter	24.2	16.1	15.7	13.8	1.62
Placer	34.7	19.9	12.2	14.4	1.84
Contra Costa	11.3	7.6	3.2	6.3	0.68
Yuba	17.4	14.7	17.9	13.7	1.49
Solano	21.3	15.2	11.8	11.6	1.40
Santa Clara	16.3	8.8	11.0	8.1	1.05
Alameda	13.9	8.4	7.0	6.8	0.86
Sonoma	19.9	12.8	8.9	10.1	1.22
Yolo	20.0	15.3	10.0	14.7	1.40
San Joaquin	26.9	22.0	19.5	17.9	1.97
San Mateo	10.7	5.0	8.7	5.0	0.71
Weighted average ³	18.07	17.04	15.26	14.13	1.51

¹ Projections are from State of California, Department of Finance 2001.

Projections are based on 2000 population figures.

² Projections are from State of California, Department of Finance 1998.

Projections are based on 1990 population figures.

³ Percent increase by decade is weighted by the amount (%) that each county contributed to respondents' origin.

Source: EDAW 2003a (Recreation Visitor On-Site Survey).

5.2.1.2 Latent Demand for Activities in the Study Area

Another variable considered in forecasting future use at the study area was new activities and opportunities that could be accommodated at the study area. In addition

to changes in existing activity use level, it is important to consider the effects of new potential activities to use in the study area. Table 5.2-3 lists the activities that respondents to the Recreation Visitor Mail-Back Survey identified as those in which they would be likely to participate. Only about 21 percent of respondents felt the Lake Oroville area did not offer the activities or events that they wanted to participate in. In addition, many of the activities listed are currently available in the study area though there may be some barriers to their use, i.e. low water limits swimming, shoreline/waterside camping.

Table 5.2-3. Visitor preference for new activities at the study area.

Activity	Percent of Respondents
Beach access/swimming area	25.7
Paddleboat, canoe and kayak rental	6.9
Athletic competition	5.9
Parasailing	5.9
Shoreline/waterside camping	5.0
Water-ski/wakeboard competition	5.0
Equestrian events	4.0
High speed boat races	4.0
Water-ski slalom course	4.0

Note: There were 101 respondents. Additional activities were listed, but only by 3% of respondents or less.

Source: EDAW 2003b (Recreation Visitor Mail-Back Survey).

Of the new activities which respondents indicated they would like, beach and swimming areas clearly dominated the responses, with nearly 26 percent of respondents. Guthrie et al. (1997) also found that there was latent demand for swimming access and beach areas in the study area. The remaining activities were selected by less than seven percent of respondents, and included non-motorized boat rental, athletic competition, parasailing, shoreline camping, water-skiing, or wakeboard competition, and equestrian events. Currently, swimming areas, beach access, and shoreline camping are offered in the study area, but may be affected by changing reservoir levels. Study R-3 – *Assessment of the Relationship of Project Operations and Recreation* explores this topic in more detail. Equestrian events are also currently offered in the study area.

5.2.1.3 Additional Facilities or Special Events

Another variable which could potentially influence future visitation is the addition of new facilities or new special events in the study area. Household Survey respondents were asked if certain facilities would motivate them to visit the Lake Oroville area (either more often or for the first time, depending on whether they had visited before or not). The interviewer read to the respondent a list of facilities from which they could choose.

About 70 percent of Household Survey respondents who had never visited the Lake Oroville area said that at least one of the listed facilities would motivate them to visit the Lake Oroville area for the first time. About 85 percent of previous visitors to the Lake Oroville area said that at least one of the listed facilities would motivate them to visit the area more often. The most popular facility for both groups of respondents was a floating restaurant on Lake Oroville. Also popular among respondents who would be visiting for the first time were an expanded outdoor center (about 31 percent), warm water swimming/beach areas (about 30 percent), a water park (27 percent), showers at DUAs (about 26 percent), and children's play areas (about 21 percent). For respondents who have visited the Lake Oroville area before, the second most popular new facility was warm-water swimming/beach areas (about 38 percent), followed closely by showers at DUAs (about 37 percent). All facilities (except more RV sites for people with disabilities) were selected by at least 20 percent of respondents.

Table 5.2-4. Facilities (from a given list) that would motivate Household Survey respondents to visit the Lake Oroville area for the first time or more often.

Facility	Percentage of Respondents that would visit...	
	First Time	More Often
None or don't know	30.5	15.3
Selected one or more from a given list	69.5	84.7
Floating restaurant on Lake Oroville	37.1	38.6
Expanded outdoor center	30.5	30.5
Warm water swimming/beach areas	29.8	37.8
Water park	27.2	29.7
Showers at DUAs	25.8	36.9
Children's play areas	20.5	27.7
More full hook-up RV sites	15.2	21.7
More RV sites for people with disabilities	13.9	19.3

Note: There were 151 respondents who had never visited the Lake Oroville area and 249 respondents who had visited the Lake Oroville area. Respondents could choose more than one facility.

Source: EDAW 2003c (Household Survey).

Household Survey respondents were also asked if certain special events would motivate them to visit the Lake Oroville area either more often or for the first time, depending on if they had previously visited the area or not. The interviewer read to the respondent a list of facilities from which they could choose. Seventy percent of Household Survey respondents who have not previously visited the Lake Oroville area said that at least one of the special events would motivate them to visit for the first time. About 85 percent of previous visitors to the Lake Oroville area said that at least one of the special events would motivate them to visit more often. Of the listed events, the most popular among respondents who would be visiting for the first time was food/beverage festivals with 25 percent of respondents, followed by canoe/kayak/river-

related events with about 24 percent of respondents. Also popular were fishing events and powerboat races (about 22 and 20 percent of respondents, respectively). For respondents who had previously visited the area, fishing events were the most popular with about 37 percent of respondents. Also popular were food/beverage festivals (about 25 percent of respondents), water-skiing events (24 percent), powerboat races (22 percent) and canoe/kayak/river-related events (about 22 percent).

These results suggest that certain new or enhanced recreation facilities and types of special events could potentially increase visitation and bring new visitors to the Lake Oroville area. However, the extent that these additional visits would occur would depend on many variables.

Table 5.2-5. Special events (from a given list) that would motivate Household Survey respondents to visit the Lake Oroville area for the first time or more often.

Special Event	Percentage of Respondents that would visit...	
	First Time	More Often
None or don't know	29.8	14.9
Selected one or more from a given list	70.2	85.1
Food/beverage festivals	25.2	24.5
Canoe/kayak/river-related events	23.8	21.7
Fishing events	21.9	36.9
Powerboat races	19.9	22.1
Living history demonstrations	17.2	15.7
Water-skiing events	15.2	23.7
Target shooting competition	14.6	13.3
Mountain bike races	13.2	15.3
Equestrian events	9.9	8.8
OHV related events	9.3	12.4
Sailing events	8.6	11.6
Triathlons	8.6	10.0
PWC events	7.9	14.1

Note: There were 151 respondents who had never visited the Lake Oroville area and 249 respondents who had visited the Lake Oroville area. Respondents could choose more than one special event.

Source: EDAW 2003c (Household Survey).

5.2.2 Regional Variables

On a regional level, variables such as the regional economy and demand for certain types of recreation settings and activities may influence future use within the region and study area.

5.2.2.1 Regional Economy

Average income of residents of Butte County is significantly below regional, State, and national averages. In 2000, Butte County had the lowest median household income in

the Sacramento Valley region at \$31,924. Average household income level in the county was 33 percent below the California median household income (\$47,493), and was also well below the national median (\$41,994). The City of Oroville had the lowest median household income (\$29,911) of any community in Butte County in 2000. The City of Oroville also has relatively high poverty rates. One third of all residents in Oroville have an income below the poverty level and 49 percent of all children are living below the poverty level. East Oroville, which is the part of Oroville adjacent to Lake Oroville, has lower poverty rates (6.1 percent of the population) and considerably higher income levels. In contrast, south Oroville has high poverty rates (41 percent) and lower incomes levels (TCW Economics 2003).

Butte County has a relatively high proportion of retirees. About 19 percent of the population of the Chico-Paradise Metropolitan Statistical Area (MSA), which corresponds to the boundaries of Butte County, is 65 years or older. This ranks the area 14th nationally and places it in the same category as retirement centers in Florida such as Palm Beach, Daytona Beach, and Tampa (TCW Economics 2003).

As California's population increases, the number of people at the lower end of the income scale is increasing at a disproportionately higher rate. Barriers to participation to those with lower income include lack of finances, lack of transportation, lack of free time, and lack of information about recreation opportunities (DPR 2003). People significantly less likely to visit an outdoor recreation site include those with low levels of socioeconomic status; low levels of assimilation; those who felt discriminated against at recreation sites; and those who were of African-American descent (Chavez 2001). For more details on economic analysis, see Relicensing Study R-18 – *Recreation Activity Spending and Associated Economic Impacts*.

5.2.2.2 Demand for Recreation Setting Type

The survey conducted for the *Public Opinions and Attitudes on Outdoor Recreation in California* (DPR 1998) also questioned respondents as to their preferences and use of five broad types of outdoor recreation areas (Table 5.2-6). Almost 70 percent of respondents preferred either natural and undeveloped areas or nature-oriented parks and recreation areas. Although preferred, it appears that these recreation area types are not the most-used on a weekly basis; highly-developed parks and recreation areas were the most used. Based on the desire for a less-developed recreational setting expressed by many California residents, overall demand can be characterized as generally high for the type of natural setting that is available in the study area.

Table 5.2-6. Californians' preference for and use of five types of outdoor recreation areas.

Type of Area	Preference (percent of respondents)	Use of area once a week or more (percent of respondents)
Natural and undeveloped areas	39.4	11.7
Nature-oriented parks and recreation areas	30.0	9.7
Highly developed parks and recreation areas	10.2	20.5
Historic or cultural building, sites or areas	9.3	2.2
Private, not public, outdoor recreation areas and facilities	11.1	12.9

Source: DPR 1998.

5.2.2.3 Demand for Activities

The DPR publication *Public Opinions and Attitudes on Outdoor Recreation in California* 1997 gives the latest information on Californians' interest and participation in different activities, including latent demand and support for public funding of outdoor recreational needs. When demand for recreation opportunities or activities exceeds the availability of facilities, an unmet or latent demand arises. In a survey conducted for the DPR study, Californians were asked whether they would increase their participation in a particular activity if good opportunities were available. Respondents were also asked which activities should give be the highest priority for public spending. Of the 43 activities from which respondents chose, 16 apply to the study area. Table 5.2-7 lists the latent demand and public support for the 16 activities that apply to the study area.

High unmet demand and high public support for walking, camping in developed sites, trail hiking, and picnicking in developed sites indicate that these activities may increase in the future. This means that more people may participate in these activities if more opportunities become available and that the public supports funding growth in these activities. Nine of the 16 activities have low latent demand and low public support, including several boating activities. However, these levels of latent demand and public support are for the entire State of California, and may not necessarily reflect demand and public support levels within the study area.

Table 5.2-7. Latent demand and public support for various activities.

Activity	Level of Latent Demand	Level of Support for Public Funding
Walking	High	High
Camping in developed sites	High	High
Trail hiking	High	High
Picnicking in developed sites	High	High
Swimming in lakes, rivers, ocean	High	Moderate
Fishing – freshwater	High	Moderate
Horseback riding	Moderate	Low
Driving for pleasure	Low	Low
Kayaking, rowboating, canoeing	Low	Low
Mountain biking (not on paved surfaces)	Low	Low
Hunting	Low	Low
Target shooting	Low	Low
Powerboating	Low	Low
Sailboating and windsurfing	Low	Low
Waterskiing	Low	Low
4 wheel drive off paved roads	Low	Low

Source: DPR 1998.

Additional sources of information regarding demand for activities include sales of fishing and hunting licenses. DFG data indicate that the overall number of fishing licenses sold in California has decreased over the last six years by 16 percent (Table 5.2-8). Fishing license sales to California residents have also decreased by almost 16 percent since 1996. One year non-resident license sales have decreased by over nine percent in the last seven years and non-resident one-day license sales have decreased the most, almost 27 percent. However, regional activity projections in Cordell (1999), suggest that fishing will grow within the Pacific region over the next 50 years (California, Oregon, Washington, Alaska, and Hawaii).

Hunting license information also indicates demand for this activity, which generally appears to be declining (Table 5.2-9). Overall, the sale of resident hunting licenses has decreased approximately 14 percent since 1996. There was a seven percent decrease between 2002 and 2003 in the sale of resident hunting licenses, the biggest decrease since 1996. Overall, non-resident hunting license sales have increased since 1996 by two percent despite a nine percent decrease in sales between 2002 and 2003. Despite an increase in duck hunting license (stamp) sales between 1996 and 2000, sales have been declining since 2000 with a significant drop (14 percent) between 2002 and 2003. One-day waterfowl license sales were significantly declining between 1996 and 2002, but did increase by 11 percent between 2002 and 2003.

Table 5.2-8. Fishing license sales in California (1996-2002).

Type of Fishing License	Number of Fishing Licenses Sold by Year							Percent Change (1996–2002)
	1996	1997	1998	1999	2000	2001	2002	
Resident	1,403,126	1,385,421	1,289,657	1,271,930	1,265,436	1,228,909	1,179,660	-15.90
Non-resident (1 year)	12,448	12,070	11,441	11,659	11,663	11,564	11,253	-9.60
Non-resident (10-day)	16,752	20,430	20,951	14,611	14,418	13,867	12,256	-26.80
Total Licenses:	1,432,326	1,417,921	1,322,049	1,298,200	1,291,425	1,254,267	1,203,020	-16.01

Source: DFG 2004.

Table 5.2-9. Hunting license sales in California (1996-2003).

Type of License	Number of Hunting Licenses Sold by Year								Percent Change (1996–2003)
	1996	1997	1998	1999	2000	2001	2002	2003	
Resident Hunting	300,530	288,652	281,741	285,667	284,403	286,679	280,664	259,845	-13.5
Non-resident Hunting	3,434	2,941	2,945	3,246	3,441	3,588	3,865	3,514	+2.3
Resident–Deer Tag	156,879	154,047	147,999	149,791	149,531	149,883	147,250	143,856	-8.3
Non-resident–Deer Tag	509	512	575	620	639	658	703	613	+20.4
Duck stamps	74,626	76,110	76,308	79,115	78,272	74,274	71,463	61,426	-17.7
1-day Waterfowl License	33,698	37,044	27,864	20,381	15,084	13,229	11,843	13,162	-60.9
2-day Waterfowl License	6,662	7,614	12,144	16,347	17,333	16,568	15,510	2,131	-68.0

Source: DFG 2004.

Two-day waterfowl licenses decreased by 86 percent between 2002 and 2003. Cordell's (1999) projections also suggest that hunting participation in the Pacific region will decline over the next 50 years.

5.2.2.4 Gaps Between Regional Activity and Facility Supply and Demand

Interviews with managers from 22 lakes and reservoirs in the region conducted for Study R-14 – *Assessment of Regional Recreation and Barriers to Recreation* indicate that visitation is expected to increase at the majority of regional lakes and reservoirs, but that only about half of them are expected to have facilities sufficient to accommodate increased use for some activities. The anticipated lack of supply of recreation facilities at other sites in the future may generate increased demand for recreation at Lake Oroville, which offers similar recreation experiences.

Although most of the regional lakes and reservoirs reportedly have enough day use facilities to meet expected future demand, it was predicted that there will be insufficient facilities for the following activities: camping facilities at eight lakes and reservoirs, boat launching and restroom deficiencies at three lakes and reservoirs, and vehicular accessibility problems (roads and parking) at seven lakes and reservoirs. Latent demand for camping may be increasing, as there are generally few plans for further development of camping facilities at the sites where facilities are forecast to be deficient.

5.2.3 Future Trends in Outdoor Recreation

Projections of recreation demand and potential use over the 50-year planning period requires an understanding of past and current recreation trends and likely future trends in outdoor recreation. This section discusses these trends, which provide a basis and context for the quantitative projections presented later in this report. This discussion reports the findings of a panel of specialists in the field of recreation research and management. This “expert judgment” approach, combined with a review of relevant research and literature in the field, is one of several approaches often used to develop recreation use forecasts (Loomis and Walsh 1997). The panel of recreation experts from EDAW, Inc. and TCW Economics assessed the potential effects of known factors of study area visitation. Pertinent recreation trend research literature reviewed for this study included the following sources:

- *Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends* (Cordell 1999);
- *California Outdoor Recreation Plan 2002* (DPR 2002);
- *Public Opinions and Attitudes on Outdoor Recreation in California 1997* (DPR 1998);
- *California Outdoor Recreation Plan 1993* (DPR 1994);

- *Demographic Change and Recreation Activity Trends* (Green, Cordell, and Stephens 2003a);
- *Regional Demand and Supply Projections for Outdoor Recreation* (English et al. 1993);
- *Boating Trends and the Significance of Demographic Changes* (Green, Cordell, and Stephens 2003b);
- *Product Innovation: The Key to Growth in the Boating Industry* (Polson 1998);
- *Assessing and Evaluating Recreational Uses of Water Resources: Implications for an Integrated Management Framework* (Kakoyannis and Stankey 2002);
- *Recreation Economic Decisions: Comparing Benefits and Costs* (Loomis and Walsh 1997); and
- *Cultural Diversity of Los Angeles County Residents Using Undeveloped Natural Areas* (Tierney, Dahl, and Chavez 1998).

Current participation in outdoor recreation activities is approximately ten times greater than it was in 1950. The increase in participation was greatest in the decade from 1950 to 1960 “due to increases in leisure time, income, and automobile ownership,” as well as expanded access to recreation areas, free access to recreation areas, and new technological advances and lower costs of recreational equipment. Since the 1960s, the rate of growth in outdoor activity participation has slowed, but continues to rise. This slowdown has occurred for multiple reasons, including higher gasoline prices, less discretionary time, demographic changes, real household income levels, and a lack of large expansions to the amount of land available for recreation (e.g., new national parks, forests, etc.), among other reasons (Loomis and Walsh 1997).

In the future, several factors will affect participation in outdoor recreation activities, including population, age, demographics, income, education, leisure time, past experience, and the supply of recreation facilities (Cordell 1999). Other factors are also known to affect recreation visitation, including weather, the national economy, wildfires, and the quality of recreational opportunities. Several of these most pertinent factors are discussed below.

Activity Preferences

Over the past 20 years, some of the fastest growing outdoor recreation activities (in number of participants) have included walking, hiking, bird watching, sightseeing, bicycling, and developed camping. Participation in these types of activities is expected to continue to increase, which is likely to increase visitation to the study area. Conversely, other activities are increasing at a much slower rate. Activities that are increasing at slower rates include swimming, visiting beaches, and primitive camping. It

is anticipated that these activities will continue to grow at slower rates, which may affect growth in visitation to the study area.

Adventure and High Risk Activities

Demand for adventure/high risk activities (e.g., mountain biking, whitewater rafting, mountain climbing, etc.) is high and is expected to continue to increase in the future. Often, specialized recreation facilities are needed to support these types of activities. Recreation in the study area may potentially increase or decrease in the future depending on whether opportunities (including support facilities) are available for adventure/high risk activities.

Age

According to recreation use projection models developed by English et al. (1993), the percentage of county residents over 12 years of age has a very minimal relationship to total recreation visits to a recreation area. However, age does seem to affect participation in specific activities. For example, as the general population has aged, preference has shifted from tent camping to recreational vehicle (RV) camping. This is especially pertinent in California, where in 20 years, nearly one-third of the population will be between the ages of 55 and 75 (Tierney, Dahl and Chavez 1998). This shift in activity preference may potentially increase use in the study area, if opportunities are available for this aging segment of the state's population.

Boating Preferences

Visitor preferences for boating have shifted in the past 10 years and are expected to continue to shift in the future. PWC use, kayaking, canoeing, and rafting are some of the fastest growing boating-related activities. Some sources such as Green, Cordell, and Stephens (2003b) and Cordell, Betz, and Green (USFS website) show motorboating among the slowest-growing boating-related activities, whereas other sources such as DPR 1998 show a larger increase in motorboating, and Cordell's (1999) projections demonstrate large increases in motorboating use in the Pacific region. Given that boating is a popular activity in the study area, shifts in boating preference may affect visitation. Recreation in the study area may potentially increase in the future based partly on whether available opportunities (including support facilities) reflect these shifting preferences in boating.

Consumptive and Non-Consumptive Recreation

Demand for and participation in consumptive recreation activities, such as hunting, has significantly decreased in the past decade, though the decrease has been less drastic in more rural areas. It is expected that participation in these types of activities will continue to decrease in the future. Conversely, participation in nature appreciation and other non-consumptive recreation activities such as wildlife viewing, has significantly increased over the past decade and is expected to continue to increase. It is anticipated that this increase in demand for non-consumptive recreation activities will

continue and will likely increase use in the study area, provided opportunities for these types of activities are available.

Cultural and Ethnic Shifts in Population

According to the 2000 U.S. Census, Hispanic and Asian/Pacific Islander populations were two of the fastest growing ethnic groups in California. By 2030, it is anticipated that Hispanic people will represent approximately 43 percent of the State's population. These types of cultural/ethnic shifts may affect preferences for recreation opportunities. However, recreation research is inconclusive regarding the effect that cultural and ethnic background has on recreation preferences. It is unclear how cultural/ethnic shifts may potentially affect visitation at study area recreation sites (see Study R-14 – *Assessment of Regional Recreation and Barriers to Recreation* for more information on activity preferences by ethnicity).

High-Tech Recreation

Recreation activities are increasingly influenced by technological advances in equipment. Some recent technological advances in recreational equipment include affordable GPS devices, weather-proof fabrics, 4-stroke engines (for use in snowmobiles, PWC, etc.), fish finders, and lightweight camping gear, among others. These technological advances can affect recreation in various ways, but in general, they have made some outdoor activities more accessible to a larger portion of the recreating population. For example, recent innovations in watercraft have increased the popularity of and participation in boating-related activities by making boating less expensive, cleaner, and safer. In the study area, technological advances in recreation equipment and activities may potentially increase use; however, the long-term effect of technology on recreation in the study area is uncertain.

Income

Past research suggests that income has a significant effect on outdoor recreation preferences. The lack of discretionary income (and related constraints on leisure time and transportation) has been found to limit some lower-income populations to recreation activities closer to their homes. The lack of discretionary income may ultimately shift preferences for recreation facilities and opportunities. This is especially pertinent as the number of people in lower income brackets is expected to increase at a disproportionate rate compared to those in higher income brackets in California (Tierney, Dahl, and Chavez 1998). In the study area, the potential effects these income trends may have on visitation include less overnight use and less total use, among others.

Management Priorities

Management priorities can significantly influence visitation by directly or indirectly encouraging or discouraging recreation use of the study area. For example, a management approach that emphasizes nature study may potentially result in a decrease in powerboating in the study area. Additionally, external influences (e.g.,

drought, drinking water needs, National security, etc.) can often influence study area-specific management priorities. Although changes in future management directions and potential external influences will likely affect visitation, the nature of these effects is unknown.

Motorized (OHV) Recreation

OHV-related recreation is very popular in California and is expected to increase in the future. Similar to adventure/high risk activities, OHV use often requires specialized facilities and management strategies. Although Statewide OHV use may increase, a large increase in OHV use within the study area may not be accommodated due to spatial limitations of the existing OHV area and the lack of other suitable areas within the study area to accommodate OHV use.

Past Trends in Visitor Use at LOSRA

In evaluating future visitation, past visitation trends are often the best predictor of future visitation, especially in the short term (5 to 20 years). Over the past 25 years, visitation at major reservoirs in northern California, including Lake Oroville and other regional reservoirs such as Lake Almanor, appears relatively flat (or slightly decreasing, especially in the 1990's). Visitation has not kept pace with population gains of surrounding counties. This trend is not fully understood, and could change in the future especially if high population growth continues along with projected growth in the primary activities that occur at Lake Oroville.

Population

The population of California grew almost 14 percent during the 1990s. This robust increase is expected to continue in the future. As the State population has increased over the past 10 years, many traditionally non-urban counties, such as Butte County, have seen significant increases in their population due in part to relocation (from urban centers to less-populated rural areas). Specifically, the population of many of the counties in the Central Valley increased more than 17 percent during the 1990s. The population of Butte County is expected to grow 16–26 percent for each of the next 4 decades. This relocation is expected to continue in the future and could increase demand for recreation opportunities and facilities in more rural areas, such the study area.

Reservoir Attributes and Visitor Preferences

With demand for reservoir recreation relatively flat over the last 25 years and no new major reservoirs being developed for recreation in the next 10–20 years (with the possible exception of Sites Reservoir in Tehama/Glenn County, which is currently undergoing NEPA/CEQA review), potential increases in visitation at any particular reservoir will depend in large part on that reservoir's proximity to population centers and the relative attractiveness of the reservoir's attributes, including its facilities, resource conditions (water, fishery, and wildlife), access, and whatever unique features it may

offer. The extent to which these attributes are enhanced in the study area will affect overall recreation use of the area to some extent.

User Fees and Other Trip-Related Costs

In the short term, new and/or increased user fees tend to result in reduced visitation. In the long-term, most visitors are likely to accept moderate increases in user fees and continue to visit the area; however, some visitors may be “priced out” of visiting the area. “Priced-out” visitors may reduce or eliminate visits to the area, choose activities with lower fees, or visit recreation areas with lower fees for their chosen activities. Increases in other costs associated with recreation such as gasoline prices can also affect the level of visitation. Higher gasoline prices have been shown to reduce the number and distance of trips that visitors take from home, as well as reduce participation rates in motorized activities such as motorboating (Appendix B). Higher user fees and other associated costs can be expected to potentially reduce visitation to the study area. It should be noted, however, that over the past 15 years, user fees at the LOSRA have remained constant in most years, and increased in some years but also decreased in other years.

5.3 PROJECTED RECREATION USE

Quantitative recreation use projections are based on existing use activity data. Activities have been categorized as to whether demand is expected to decline or to increase at a low, moderate, or high rate. Sources considered in the development of these categorizations include past activity trends, Cordell's (1999) projection data, and variables and information in Section 5.2. An annual percent growth was determined for each category and applied to existing use activity RD data for each site. Baseline activity data for Lake Oroville sites were adjusted to represent use under average reservoir elevations².

These projections are unconstrained, straight-line projections; Study R-8 – *Carrying Capacity* analyzes carrying capacity constraints to the projections in this section. Thus, the number of RDs presented assumes no on-site limitations, and should not be construed as predictions of actual use levels. Rather, the projections represent the amount of use that would occur if all factors remain constant, taking population growth, activity demand, and demographic changes into account. In addition to spatial, facility, social, and ecological capacity constraints which are described in Study R-8 – *Carrying Capacity*, many other factors will affect recreation use and the ability for the study area to accommodate the projected increase in demand. Thus, these unconstrained use numbers reflect recreation demand that may or may not ultimately result in use. It should be noted that long-term recreation activity participation is difficult to predict. Additionally, quantitatively predicting the potential effect of factors such as those listed in Section 5.2.3 requires many assumptions and sophisticated statistical modeling.

² Modeling showed that recreation use at Lake Oroville sites has a positive relationship to reservoir level.

5.3.1 Projected Use in the Study Area

The study area, which includes all sites both within the FERC boundary and the three sites outside of the FERC boundary, is projected to attract 3.5 million RDs by the end of the license period in 2050 (Table 5.3-1).

Table 5.3-1. Projected RDs for the study area¹.

Area	2002	2010	2020	2030	2040	2050
Lake Oroville	911,183	1,122,280	1,297,890	1,504,000	1,746,170	2,031,030
Bidwell Canyon Complex	217,709	266,080	304,830	350,030	402,830	464,600
Loafer Creek Complex	89,544	108,270	122,260	138,230	156,490	177,380
Lime Saddle Complex	162,220	198,420	227,610	261,730	301,700	348,580
Diversion Pool	20,603	22,720	25,700	29,130	33,070	37,610
Thermalito Forebay	135,720	148,600	166,640	187,130	210,440	237,000
Thermalito Afterbay	93,368	104,290	119,960	138,220	159,540	184,470
Oroville Wildlife Area	318,462	342,860	376,770	415,010	458,250	507,260
Additional Sites within FERC boundary	179,205	204,270	240,920	284,570	336,540	398,410
Feather River Fish Hatchery	160,395	184,010	218,550	259,680	308,660	367,000
Dispersed Use Sites ²	18,810	20,260	22,370	24,890	27,880	31,410
Total for Project Area	1,658,541	1,945,020	2,227,880	2,558,060	2,944,010	3,395,780
Additional Sites Outside FERC boundary	69,145	74,150	81,020	88,640	97,140	106,620
Riverbend Park	30,230	33,000	36,890	41,330	46,410	52,230
Clay Pit SVRA	18,324	19,380	20,780	22,280	23,890	25,610
Rabe Road Shooting Range	20,591	21,770	23,350	25,030	26,840	28,780
Total for Study Area	1,727,686	2,019,170	2,308,900	2,646,700	3,041,150	3,502,400

¹ These calculated values are rounded in the table and text to avoid conveying unwarranted precision.

² Dispersed sites include: Old Nelson Bar, Parrish Cove, Nelson Avenue Bridge over Thermalito Forebay, Highway 162 Overlook, Canyon Creek Bridge, South Wilbur Road TA, Tres Vias Road TA, and Toland Road TA. Also included in these totals are "other dispersed use sites" which includes any dispersed use occurring within the study area at sites other than those that are known dispersed sites.

Source: EDAW 2004.

Of the total use, 3.39 million RDs, or 97 percent, is projected to be within the Project 2100 boundary. The increase of 1.77 million RDs in the study area over 48 years would constitute a 103 percent increase in use from 2002. Use within the study area would

remain concentrated in the Lake Oroville area, which will account for slightly more than 50 percent of the total projected use for the study area in each decade. The OWA is forecast to receive the second-largest amount of use, with an estimated 507,000 RDs in 2050. Use at the Feather River Fish Hatchery would remain the third largest, with 367,000 RDs projected in 2050. Use at Thermalito Forebay would increase to an estimated 237,000 RDs by 2050, the fourth largest. The fifth-highest amount of use would be at Thermalito Afterbay, which would receive 184,000 RDs in 2050. Finally, the Thermalito Diversion Pool area and dispersed use sites are forecasted to continue to have relatively low use, with less than 40,000 RDs each by 2050.

5.3.2 Projected Use at Lake Oroville Sites

Total use at Lake Oroville is projected to more than double to 2 million RDs over the next 48 years (Table 5.3-2). At Lake Oroville, sites with large amounts of sightseeing and boating use are forecast to have the most growth over the 48-year period because these activities are forecasted to have high growth. These sites include Bidwell BR/DUA/Marina, Nelson Bar Car-Top BR, Lime Saddle BR/DUA/Marina, Loafer Creek BR, Spillway BR/DUA, Oroville Dam/Overlook DUA, Foreman Creek Car-Top BR, Dark Canyon Car-Top BR, Enterprise BR, and the Lake Oroville Visitors Center. Assuming no constraints, use at these sites is projected to at least double by 2050. Between 2010 and 2020, Oroville Dam/Overlook DUA is projected to overtake Bidwell BR/DUA/Marina as the site contributing the most to use. By 2050, Oroville Dam/Overlook DUA is projected to receive 466,000 RDs, followed by Bidwell BR/DUA/Marina with 423,000 RDs. Lime Saddle BR/DUA/Marina and the Lake Oroville Visitors Center would continue to contribute the high amounts of use at Lake Oroville with an estimated 332,000 and 241,000 RDs in 2050, respectively. The sites projected to remain lowest in overall use are facilities with smaller capacities such as Loafer Creek Equestrian Campground, Loafer Creek Group Campground, Lime Saddle Campground, Lime Saddle Group Campground, Dark Canyon Car-Top BR, Vinton Gulch Car-Top BR, and Saddle Dam TA. The other campgrounds and Car-Top boat ramps are projected to have a relatively moderate amount of use over the next 48 years.

In terms of overnight visitation, which primarily occurs at the campgrounds located on Lake Oroville, use is projected to increase. Loafer Creek Campground is projected to continue to have the most use of all six campgrounds with 43,000 RDs by 2050, followed closely by Bidwell Canyon Campground with 41,000 RDs. Though there is some camping use at Spillway BR/DUA and North Thermalito Forebay BR/DUA “en route” camping areas, it is projected to continue to be relatively minor compared to developed campground use.

Table 5.3-2. Projected RDs at Lake Oroville sites.

Site	2002*	2010	2020	2030	2040	2050
Bidwell Canyon Complex	217,709	266,080	304,830	350,030	402,830	464,600
Bidwell Canyon BR/DUA/Marina	195,457	239,410	275,080	316,840	365,810	423,300
Bidwell Canyon Campground	22,252	26,670	29,750	33,190	37,030	41,310
Loafer Creek Complex	89,544	108,270	122,260	138,230	156,490	177,380
Loafer Creek BR	29,246	35,960	41,520	48,060	55,760	64,850
Loafer Creek DUA	29,021	34,830	38,920	43,520	48,680	54,470
Loafer Creek Campground	23,531	28,200	31,460	35,100	39,160	43,680
Loafer Creek Group Campground	5,820	6,970	7,780	8,680	9,680	10,800
Loafer Creek Equestrian Campground	1,926	2,310	2,580	2,870	3,210	3,580
Lime Saddle Complex	162,220	198,420	227,610	261,730	301,700	348,580
Lime Saddle Campground	7,760	9,300	10,370	11,570	12,910	14,400
Lime Saddle Group Campground	920	1,100	1,230	1,370	1,530	1,710
Lime Saddle BR/DUA/Marina	153,540	188,020	216,000	248,780	287,250	332,470
Spillway BR/DUA	80,516	98,900	114,010	131,750	152,580	177,090
Oroville Dam/Overlook DUA	189,765	238,040	281,360	332,830	394,020	466,790
Foreman Creek Car-Top BR	14,413	17,480	19,810	22,500	25,610	29,200
Dark Canyon Car-Top BR	7,009	8,550	9,780	11,210	12,870	14,820
Vinton Gulch Car-Top BR	6,733	7,980	8,800	9,720	10,760	11,930
Nelson Bar Car-Top BR	23,948	28,910	32,610	36,870	41,790	47,480
Stringtown Car-Top BR	11,645	14,060	15,850	17,910	20,270	22,980
Saddle Dam TA	4,690	5,650	6,350	7,150	8,040	9,050
Enterprise BR	9,438	11,460	13,010	14,800	16,870	19,270
Lake Oroville Visitors Center	93,553	118,480	141,620	169,280	202,340	241,850
Total	911,183	1,122,280	1,297,890	1,504,000	1,746,170	2,031,030

* The 2002 baseline RDs were adjusted upward by 9.8 percent to better reflect average reservoir levels and projections are based on the increased baseline numbers. However, unadjusted numbers are presented here to correspond with existing use numbers from Study R9 – Existing Recreation Use.

Source: EDAW 2004.

5.3.3 Projected Use at the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, OWA and additional sites within the FERC boundary

Use at the Diversion Pool area is forecast to increase 82 percent to 37,000 RDs in 2050 (Table 5.3-3). The Diversion Pool DUA is projected to remain the largest contributor to use in this area, with a relatively moderate amount of use at 26,000 RDs by 2050. The two TAs are projected to remain relatively low use sites.

The Thermalito Forebay is projected to increase in total use by 75 percent from 2002 to 2050. The North Thermalito Forebay BR/DUA is forecast to continue to have more use than the South Thermalito Forebay BR/DUA. The two Forebay sites are projected to have use levels similar to those at the four OWA sites, ranging between 84,000 and 150,000 RDs by 2050.

Use is projected to increase 98 percent at the Thermalito Afterbay due to the large projected increase in boating use at Wilbur Road BR, Monument Hill BR/DUA, and Larkin Road Car-Top BR. Wilbur Road BR is projected to double in amount of use at the site, although the projected 27,000 RDs in 2050 is a relatively moderate amount of use compared to other sites such as North Thermalito Forebay BR/DUA and OWA sites. East Hamilton Road TA, although forecast to double in use, is projected to remain a relatively low-use site.

At the OWA, there is less projected growth than at the previously mentioned areas due to lower amounts of high-demand activities such as boating and sightseeing use and declining hunting use. Use in the area is projected to increase by 59 percent over the next 48 years. The West Levee Road is projected to remain the most-used site with 148,000 RDs by 2050. The Thermalito Afterbay Outlet Area, with a projected 144,000 RDs in 2050, is forecast to overtake the East Levee Road as the second most used site in the OWA within the next eight years (between 2002 and 2010). This is due to more sightseeing and boating use at the Thermalito Afterbay Outlet Area which are high-demand activities. Conversely, the East Levee Road does not have as much sightseeing use and no boating use, but does have hunting use which is projected to decline, leading to less overall growth at the East Levee Road.

As for additional sites within the FERC boundary, visitation at the Feather River Fish Hatchery is projected to more than double by 2050, increasing to an estimated 367,000 RDs in 2050 from about 160,000 RDs in 2002. This is due to a large amount of sightseeing use at this site, an activity which is forecast to have high demand over the next 48 years. Dispersed use is projected to increase slightly and remain at a moderate level.

Table 5.3-3. Projected RDs at the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, OWA and additional sites within the FERC boundary.

Site	2002	2010	2020	2030	2040	2050
Diversion Pool						
Diversion Pool DUA	14,571	16,040	18,120	20,510	23,260	26,430
Lakeland Boulevard TA	4,004	4,420	5,000	5,670	6,430	7,300
Powerhouse Road TA	2,028	2,260	2,580	2,950	3,380	3,880
<i>Total</i>	<i>20,603</i>	<i>22,720</i>	<i>25,700</i>	<i>29,130</i>	<i>33,070</i>	<i>37,610</i>
Thermalito Forebay						
North Thermalito Forebay BR/DUA	86,065	94,330	105,910	119,070	134,030	151,070
South Thermalito Forebay BR/DUA	49,655	54,270	60,730	68,060	76,410	85,930
<i>Total</i>	<i>135,720</i>	<i>148,600</i>	<i>166,640</i>	<i>187,130</i>	<i>210,440</i>	<i>237,000</i>
Thermalito Afterbay						
Wilbur Road BR	12,637	14,330	16,800	19,730	23,210	27,340
Monument Hill BR/DUA	56,767	63,250	72,520	83,290	95,830	110,440
Larkin Road Car-Top BR	23,073	25,710	29,480	33,860	38,950	44,890
East Hamilton Road TA	891	1,000	1,160	1,340	1,550	1,800
<i>Total</i>	<i>93,368</i>	<i>104,290</i>	<i>119,960</i>	<i>138,220</i>	<i>159,540</i>	<i>184,470</i>
OWA						
South OWA West Levee Road	91,437	98,660	108,770	120,280	133,410	148,420
South OWA East Levee Road	85,889	91,700	99,690	108,580	118,500	129,580
Thermalito Afterbay Outlet	84,966	92,500	103,080	115,160	128,970	144,820
Headquarters Entrance	56,170	60,000	65,230	70,990	77,370	84,440
<i>Total</i>	<i>318,462</i>	<i>342,860</i>	<i>376,770</i>	<i>415,010</i>	<i>458,250</i>	<i>507,260</i>
Additional Sites within the FERC boundary						
Feather River Fish Hatchery	160,395	184,010	218,550	259,680	308,660	367,000
Dispersed Sites ¹	16,650	17,790	19,460	21,450	23,800	26,580
Other Dispersed Sites ²	2,160	2,470	2,910	3,440	4,080	4,830
<i>Total</i>	<i>179,205</i>	<i>204,270</i>	<i>240,920</i>	<i>284,570</i>	<i>336,540</i>	<i>398,410</i>

¹ Includes: Old Nelson Bar, Parrish Cove, Nelson Avenue Bridge over Thermalito Forebay, Highway 162 Overlook, Canyon Creek Bridge, South Wilbur Road TA, Tres Vias Road TA, and Toland Road TA.

² Includes any dispersed use occurring within the study area at sites other than those that are known dispersed sites.

Source: EDAW 2004.

5.3.4 Projected Use at Sites Outside of the FERC boundary

Of the three sites, Riverbend Park is projected to have the most growth (Table 5.3-4), due to sightseeing, boating, and walking activities present at the park, which are high-demand activities. OHV use and target shooting are moderate-demand activities, and therefore use at Clay Pit SVRA and Rabe Road Shooting Range are forecast to grow about 40 percent by 2050, compared to 73 percent growth at Riverbend Park.

Riverbend Park is estimated to have 52,000 RDs by 2050, about double that of the SVRA (25,000) or shooting range (28,000). Compared to other study area sites, the three sites outside the FERC boundary are forecast to have relatively moderate increases in use.

Table 5.3-4. Projected RDs at sites outside of the FERC boundary.

Site	2002	2010	2020	2030	2040	2050
Riverbend Park	30,230	33,000	36,890	41,330	46,410	52,230
Clay Pit SVRA	18,324	19,380	20,780	22,280	23,890	25,610
Rabe Road Shooting Range	20,591	21,770	23,350	25,030	26,840	28,780
<i>Total</i>	<i>69,145</i>	<i>74,150</i>	<i>81,020</i>	<i>88,640</i>	<i>97,140</i>	<i>106,620</i>

Source: EDAW 2004.

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6.0 CONCLUSIONS

Demand for recreation is driven by many variables and therefore projections of recreation use cannot solely be based on population changes. Project specific statistical models were developed to evaluate the influence of several variables on visitation to Lake Oroville and Thermalito Forebay. The model identified a positive relationship between reservoir level and per capita visitation at Lake Oroville. Subsequently, reservoir level modeling information showed that project operations and reservoir levels in 2020 would be very similar to past and current levels. Thus, population remained the only independent variable in the statistical models. It was determined that this was not sufficient to accurately predict future recreation demand, and that other methods would be superior. Therefore, activity projection data (Cordell 1999) was used in conjunction with Statewide latent demand and past trend information to develop projected demand categories (declining, low, moderate, and high) and discrete annual growth percentages for each category. Existing use data by activity was then projected based on these percentages. Statistical modeling results relating visitation to reservoir levels were incorporated into projections by adjusting baseline existing use data upwards by 9.8 percent to better account for average reservoir levels (existing use data from 2002–03 was based on relatively low reservoir levels that year).

The projections show a steady increase in demand for recreation in the study area, possibly resulting in 3.5 million RDs by 2050, more than doubling current recreation use. All sites are projected to increase in use, especially sites with substantial high-growth activities such as boating or sightseeing. Lake Oroville is expected to remain the dominant destination within the study area by continuing to contribute over 50 percent of the use within the entire study area. Considering past trend information, showing Lake Oroville visitation to be relatively constant, it is also possible these projections may somewhat overstate future recreation use in the study area. However, some past trend information is based on data that may be unreliable, and past trends may not continue in the future.

Although projections show 3.5 million RDs by 2050, this is an unconstrained projection of demand which may or may not be realized due to spatial, facility, social, and ecological constraints that could limit use. Where appropriate, these constraints will be applied to use projections in Study R-8 – *Carrying Capacity*. Unknown factors, along with several currently unquantifiable variables such as those listed in Section 5.2.3, may also affect future recreation use within the study area. Therefore under a wide range of possible future scenarios, monitoring is crucial to updating projections and better understanding which potential trends are occurring in the study area. A monitoring program should be incorporated into the forthcoming Recreation Resource Management Plan (RRMP) that details the visitation data to be collected (where, when, and by whom) and how often projected use estimates are reviewed and/or revised. Due to inherent limited accuracy of long-term projections, future development to accommodate increased use should be incremental and phased. This phased

development should be based on monitoring data that indicate the actual level of demand, that capacity is being approached, and that the need is apparent.

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APPENDIX A

BACKGROUND REPORT SUMMARIES

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NATIONAL RECREATION REPORTS

Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends

This report presents the results of a National study (Cordell 1999). It is a comprehensive assessment of existing trends, the current situation, and likely futures of outdoor recreation demand and supply. The past and current aspects of national demand are also examined.

This report provides an overview of the benefits and histories of outdoor recreation and wilderness as a context for the demand and supply assessment. A description of the framework that guides the assessment of trends and market shifts is provided in Chapter 2. Chapters 3 and 4 provide in-depth descriptions of the recreation resources in the country, with emphasis on private land access.

In Chapter 5, outdoor recreation participation trends are examined, with specific coverage of social group differences, international tourism, federal and state system visitation trends, and consumer spending for outdoor recreation.

In Chapter 6, models and projections of recreation participation (numbers of persons, total days of participation and trips taken away from home) are described. The status and trends in the National Wilderness Preservation System are analyzed in Chapters 7 and 8, covering demand and supply aspects as well as the makeup of users, uses, and values about Wilderness. In Chapter 9, preferences, perceptions, and attitudes of public land recreation users are reviewed. Chapter 10 highlights key findings of this Assessment and discusses their implications for the future of outdoor recreation.

The assessment determined that benefits of wilderness are underestimated by at least 50 percent and that wilderness management has fallen from being a serious priority of the federal land management agencies.

Nationwide, the outdoor recreation market is expected to continue to grow and visitor demand will increase, thus presenting unique challenges for both private and public land managers.

STATEWIDE RECREATION REPORTS

California Outdoor Recreation Plan 2003

The *California Outdoor Recreation Plan* (CORP) describes federal and state land management agencies and their programs for managing public recreation resources. The report also summarizes local, nonprofit, and private sector providers of recreation within the state.

The CORP discusses demographic trends and challenges that are affecting and will continue to affect California's recreation in the future. Trends include robust population growth, urbanization, and growth of inland counties. Demographic shifts include a continuing increase of Hispanic and Asian populations as a percentage of the total state population. The "baby boom" generation is expected to become a more active senior population than today's seniors.

Popularity of nature study, adventure-based activity, and high-technology recreation are all trends that will influence future recreation numbers and types of recreation participation.

Outdoor recreation is very important to Californian lifestyles in general. Recreational walking was the number one activity among surveyed California residents. There is a high, unmet demand for several activities as follows:

1. Recreational walking
2. Camping at developed sites
3. Trail hiking
4. Attending outdoor cultural events
5. Visiting museums, historic sites
6. Swimming in lakes, rivers, ocean
7. General nature, wildlife study
8. Visiting zoos and arboretums
9. Camping in primitive areas
10. Beach activities
11. Use of open grass or turf
12. Freshwater fishing
13. Picnicking in developed sites

The CORP lists issues facing parks and outdoor recreation and outlines actions for dealing with the challenges faced by park managers. Issues include funding, access to parks and recreation areas, natural and cultural resource protection, and leadership in recreation.

The CORP also outlines health and social benefits of recreation. Wetlands and future reports to be published by DPR are also discussed (DPR 2003).

Public Opinions and Attitudes on Outdoor Recreation in California – 1997

The *Public Opinions and Attitudes on Outdoor Recreation in California* study focused on two areas: the public values, opinions, and attitudes on outdoor recreation in California; and the demand for, and participation in over 40 selected outdoor recreation activities. The survey consisted of 2,010 telephone interviews, representing all of the counties in the state. Of these respondents, 1,506 agreed to and were mailed a questionnaire and

a follow-up postcard if they failed to respond to the mail questionnaire. Most of the mailed questionnaires were in English (1,459); however, 47 Spanish questionnaires were sent to Spanish-speaking households.

As for their attitudes and beliefs, most Californians thought that “outdoor recreation areas and facilities are very important to their quality of life,” felt they “are fairly satisfied with available public outdoor recreation areas and facilities,” and thought the condition “of public outdoor recreation areas and facilities in California are the same or better than they were 5 years ago” (pg 11). Although Californians visited “highly developed parks and recreation areas” most regularly, they preferred natural and undeveloped areas in the greatest proportion.

Walking was the activity undertaken by over 80 percent of respondents and accounted for the greatest average number of activity days. Other top activities included visiting museums/historic sites; use of open grass or turf areas; driving for pleasure; beach activities; visiting zoos and arboretums; and picnicking in developed sites. “In general, participation rates appear to be higher for activities that are less expensive, require less equipment, and need fewer technical skills” (pg 15).

The study found 13 activities with high unmet demand. These were the same activities described as having high latent demand in the *California Outdoor Recreation Plan* (2003). The study combined data on latent demand and support for public funding of the over 40 listed activities and thereby assigned 9 activities to the top priority level. These activities were walking, trail hiking, camping in developed sites, camping in primitive sites, general nature study, use of open grass areas, picnicking in developed sites, visiting museums/historic sites, and visiting zoos and arboretums.

Spending priorities of Californians tended “to focus more on existing facilities than expanded opportunities for outdoor recreation areas and facilities” (pg 36). Californian attitudes toward changes to park and recreation facilities and services showed that about 78 percent approved of developing more community parks, and 76 percent approved of constructing simple campgrounds and developing more horseback riding, hiking, and mountain biking areas where no motorized vehicles are allowed.

Noting the growth in the Hispanic population of California and its future influence on recreation participation, the 1997 survey also included a section that compared the survey results of Hispanic and non-Hispanic respondents. Focusing on Hispanic recreational preferences is important as this group is expected to grow significantly as a percentage of the population in coming years.

Hispanic respondents were more likely to use and prefer highly developed areas (excluding historic and cultural sites) than non-Hispanic respondents. Hispanics and non-Hispanics also differ regarding changes to park and recreation facilities. The largest differences were for “providing more picnic sites for large groups” and “more

parking at picnic sites,” with Hispanics showing more support for these two items than non-Hispanics.

Hispanic respondents also have a different latent demand than non-Hispanic respondents. Hispanic respondents categorized use of open space areas, use of play equipment, and visiting zoos and arboretums as uses with high latent demand, whereas non-Hispanic respondents categorized these uses as moderate latent demand. Conversely, Hispanics rated trail hiking, camping (both developed and primitive), and general nature study as uses with moderate latent demand while respondents from other ethnic groups rated these items as high latent demand. The 1997 results consistently showed less Hispanic participation for the activities surveyed. Hispanics rated safe areas the highest. “Law enforcement” and “friendly, informative rangers” were also rated high in importance.

The 1997 survey described few major changes from previous studies conducted in 1987 and 1992. Some of the changes found were in preferences for funding mechanisms and the average number of participant days for general nature study, surfing, walking, basketball, sailing and windsurfing, kayaking and other non-motorized watercraft use, and freshwater fishing. Many activity participation rates grew between 1987 and 1992 and then by 1997 had declined to around 1987 levels, thus displaying an inverted “U” curve. These activities included walking; camping in developed and primitive areas; picnicking in developed sites; kayaking, rowboating, canoeing, and rafting; and saltwater and freshwater fishing. Possible explanations for this occurrence included the shifting demographic structure of California, a change in income, changing ethnicity patterns, the 1992 sampling approach, or reduced recreation participation due to time constraints of the new California economy.

Compared to the 1992 study, “high” latent demand activities were basically unchanged, although the willingness to pay for the activities had changed. Finally, there has been a shift in attitudes on spending preferences. Comparing data from 1987 and 1992 to the data from 1997, support has increased for acquisition of land for park and recreation purposes, facility maintenance, and construction of new facilities (DPR 1992). Table A-1, compiled from the 1997 report, summarizes the changes from 1987 to 1992 and 1997.

In 1992, public support was high for government funding of all of the activities except for two. Beach activities had moderate support, and picnicking at developed sites came in with low support. From 1992 to 1997, public support changed from high to moderate for freshwater fishing, and picnicking went from low to high for public support. Some differences were identified between individual willingness to pay and a high ranking of support for public funding.

Youth preferences were reviewed in the 1992 report. The top three activities participated in among youth included walking, bicycling, and playing on equipment. The

favorite activities among youth included softball/baseball, basketball, swimming, and beach activities. Youth were more interested in softball, baseball, football, and soccer than adults. Recreation Participation Days were slightly higher for youth than adults.

Table A-1. Comparison of 1992 and 1997 California Public Opinion Reports

	1987	1992	1997
Importance of Recreation to Quality of Life (percent)			
Very Important	43.6	56.1	61.9
Important	25.7	20.2	20.1
Neutral	21.9	13.5	12.8
Unimportant	4.5	4.7	2.9
Not at all important	4.2	5.5	2.3
Satisfaction (percent)			
Very Satisfied:	28.7	21.4	27.6
Satisfied:	34.0	28.2	32.7
Neutral:	27.7	34.8	29.2
Unsatisfied	6.4	9.8	7.5
Not at all Satisfied:	3.1	5.8	3.4
Type of outdoor recreation area preferred (percent)			
Natural and undeveloped	26.5	41.8	39.4
Nature Oriented parks and rec. areas	29.2	26.3	30.0
Highly developed park and rec. areas	21.1	14.2	10.2
Historic or cultural buildings or areas	9.3	7.1	9.3
Private outdoor rec. areas and facilities	9.8	10.6	11.1
Increased spending supported (percent)			
Acquire more land:	45.5	45.9	57.1
Maintain Facilities:	54.6	52.1	64.8
Provide education and activity programs:	47.9	45.7	53.2
Build new facilities:	42.0	41.3	57.5
Rehabilitate existing facilities:	57.8	57.4	68.4
Protect natural and cultural resources:	71.6	60.8	67.6
Importance of Protection of the Natural Environment (percent)			
Strongly agree	No data	78.5	72
Moderately agree		15.9	20.5
Say Facilities are too crowded	No data	70	60

Source: DPR 1997.

State Parks Path to Our Future Project: Key Challenges and Strategies, 2000

This document contains the key challenges facing DPR in 2000. Five prioritized tiers of challenges and strategies are listed. These recommendations followed a 6-month process called the Path to the Future Project. This project was initiated by DPR's Director to help State parks transition into the 21st century and become more relevant to Californians. The challenges were identified as a result of workshops and a summit that included traditional park activists, environmentalists, and cultural and recreation stakeholders, numerous community leaders and advocacy group representatives.

The challenges and strategies were prioritized by DPR's Resources Committee into five tiers. There were two challenges within the first priority tier. The first was to ensure more dependable funding to avoid overreliance on fee collection. The second was to make State parks a part of the lives of all Californians. The challenge in the second priority tier was to create a Statewide Comprehensive Park and Recreation Master Plan. The third priority tier included four challenges: First, shift from managing natural resources as representational islands to managing them as sustainable ecosystems. Actions required for this challenge included connecting existing units and expanding existing units. The second challenge in this tier was to increase the availability and accessibility of the State Park system to the State's major population centers and urban populations. The third challenge was to expand the range of recreation opportunities to keep up with the needs of California's growing population and changing lifestyles. To do this, DPR would have to increase the number of camping facilities and facilities for traditional user groups; provide a larger range of recreation options such as off-highway vehicle (OHV) parks, recreational vehicle (RV) campgrounds, cabins/lodges, and trail hostels; and expand parks and facilities to accommodate camping and day use by larger groups. The fourth challenge in this tier was to expand the cultural and historical preservation role of the Department. The challenge in the fourth priority tier was to promote more public involvement and participation. The fifth priority tier of challenges dealt with the Department itself and included changing the internal culture of and creating a new image for the Department (DPR 2000).

REGIONAL RECREATION REPORTS

The Economic Value of Sonoma County Equestrian Activities

This report outlines the impacts of the equestrian sector on Sonoma County economy. With a nearly 14,000 horses in 1999, the vibrant equestrian sector of Sonoma County has a large impact on the county economy. At the same time, it is sustaining the green landscape of the county and a traditional American culture.

With a capital stock near 750 million dollars, the equestrian economy is generating a production value of 185 million dollars. When the multiplier effect on other sectors of the county economy is added, the equestrian sector impact on the county is above 250 million dollars (Benito 1999).

The report does not state what percentage the equestrian sector is of the whole economy.

Central Valley Project Improvement Act

In one of its last actions of the session, the 102nd Congress passed multipurpose water legislation, which was signed into law October 30, 1992. Previously referred to as H.R. 429, Public Law 102-575 contains 40 separate titles providing for water resource projects throughout the West. Title 34, the Central Valley Project Improvement Act,

mandates changes in management of the Central Valley Project, particularly for the protection, restoration, and enhancement of fish and wildlife.

Eleven major areas of change include the following:

- Approximately 800,000 acre-feet of water dedicated to fish and wildlife annually;
- Tiered water pricing applicable to new and renewed contracts;
- Water transfer provision, including sale of water to users outside the CVP service area;
- Special efforts to restore anadromous fish population by 2002;
- Restoration fund financed by water and power users for habitat restoration and enhancement, and water and land acquisitions;
- No new water contracts until achievement of fish and wildlife goals ;
- No contract renewals until completion of a Programmatic Environmental Impact Statement;
- Terms of contracts reduced from 40 to 25 years with renewal at the discretion of the Secretary of the Interior;
- Installation of the temperature control device at Shasta Dam; implementation of fish passage measures at Red Bluff Diversion Dam;
- Firm water supplies for Central Valley wildlife refuges; and
- Development of a plan to increase CVP yield.

The EIS reviewed the potential impacts of CVPIA alternatives.

The Economic Value of Marin County Equestrian Activities

This report is similar to the report regarding Sonoma County, but it also discusses the importance of the equestrian sector on preserving open space and quality of life. The report also outlines the connection between the farming and equestrian sectors of the economy.

The yearly value of the supply of goods and services for equestrian activities in Marin County is 104.6 million dollars: 97.1 million dollars produced within Marin County, and 7.8 million dollars imported from other counties. The production value of the primary equestrian sector—activities of private households and commercial operations with horses—is 88.8 million dollars and that of businesses and trades that support or benefit from the primary sector is 8.3 million dollars.

The relative importance of equestrian activities in Marin County is large, even after the decline in the number of horses during the last 10 years. Without counting those businesses and trades that support equestrian activities, more than 1,500 households have made, by their own choice and preferences, major investments in this activity (that now amount to a capital of 356 million dollars). Equestrian activities in turn are closely interlinked with farming activities via field crop production (hay and silage) and pastures.

The capital stock of equestrian activities combined with that of farming is the backbone of agriculture in Marin County (Benito 1999).

The report does not state what percentage the equestrian sector is of the whole economy.

Sierra Nevada Ecosystem Project Report

The Sierra Nevada Ecosystem Project Report (SNEP) was designed to advise Congress on the status of the health of the Sierra Nevada Ecosystem. The SNEP report makes several conclusions as follows:

- Recreational users are primarily Californians who live outside the Sierra Nevada.
- Recreational users are primarily Caucasians and do not represent the ethnic diversity of the rest of the state of California, where most of the recreationists live.
- Recreational users are primarily traveling to the area via private automobile.
- Recreational users are primarily male (especially in the summer).
- Recreational users in the winter are more affluent and well educated than users in the summer.
- Each wilderness permit issued for a stock user results in nearly twice as many Recreation Visitor Days as each wilderness permit issued for backpackers, with the additional impact of stock use on those permits and the associated impacts on riparian zones and subalpine meadows.
- Recreational activity in isolated portions of the Sierra Nevada is highly dependent upon access to urban centers (e.g., the Tioga Pass road closes for part of each year).
- Recreational activities in particular areas are often linked to recreational activities in other areas in the Sierra Nevada, California, and the West for out-of-state visitors.
- The relative importance of skiing in traditional ski resort communities is declining as spring, summer, and autumn activities continue to grow in importance and skiing stays flat.
- Levels of recreational activity vary widely on a seasonal and annual basis in response to many factors outside either the Sierra Nevada or resource management policy.

This report states that a doubling of the population of California and Nevada between 1990 and 2040 will not necessarily double total demand for recreational activity in the region and increase conflicts between different types of recreational activities. Growth in demand for recreational opportunities exceeded population growth as American incomes grew rapidly and the “baby boomers” were born and raised during the two to three decades following World War II, but demand has been stagnant since then. This shift coincided with stagnating personal incomes per capita and smaller families

following the 1946–64 “baby boom.” The growing population of California also has quite different social, demographic, economic, and ethnic characteristics than the dominant recreational users in the Sierra Nevada today. The state’s emerging population is therefore likely to have different needs and demands for recreational opportunities (UC Davis 1996).

Central and Northern California Outdoor Recreation Market Analysis

The Central and Northern California Outdoor Recreation Market Analysis consisted of 1,203 interviews, 617 of which were in central and northern California (CNC). This study was a cooperative research effort by the USFS, BLM, and San Francisco State University. Results are listed as follows:

- Over 80 percent of all residents expressed some interest in outdoor recreation and 70 percent of all respondents participated in some outdoor recreation last year.
- Most of the CNC respondents (59 percent) participated in outdoor recreation on federal lands.
- The most popular outdoor recreation activities on federal lands in the CNC region were day hiking, camping, fishing, sightseeing, and picnicking. In addition, the CNC group was more likely to motorboat, sail, participate in beach activities, and river raft.
- Trip lengths suggest more overnight trips than in other areas of the country. Average days away from home for CNC were 5.1 with 24% traveling for one day or less.
- The most highly desired characteristics of federal outdoor recreation lands were employees who are courteous, very well maintained facilities, wide variety of scenic views, visitors who are courteous and noncrowded areas.
- Survey respondents came from a broad range of demographic characteristics and included all adult age, education, and income groups. The most common characteristics of the sample were white, non-Hispanic and employed full-time (Tierney 2002).

Recreation Facilities Plan for North and South Delta – 1988

This study examined the recreation demand in the Sacramento–San Joaquin Delta and the possible recreation development alternatives that would coincide with the Delta Water Management Plan. The Recreation Facilities report described the current recreation demand, the existing public and commercial facilities, and the latent demand and proposed several sites that could be developed to meet demand. Appendix A of the Recreation Facilities report provides a comprehensive review of over 20 previous Delta recreation studies.

As recreation in the Delta area increased, new facilities were needed to meet demand. Several recreation opportunities existed that could be built concurrently with levee improvements; for example, trails, courses, and fishing areas. Boater destination islands could be made from dredge materials. Other recreation opportunities existed that were well suited or adaptable to the levee system. Some examples listed were trail systems, golf, bicycle, and motorcycle motocross, shooting ranges, areas for remote controlled vehicles, boats, and airplanes, as well as open grass areas for sports. Some other opportunities for the area that were mentioned include an “interpretive nature center,” a “working farm,” and an equestrian center. Developing Clifton Court Forebay into a regional park was also discussed. New recreation facilities could accommodate events like jet ski and windsurfing contests, boat races, and triathlon races. Raceways could accommodate destruction derbies, tractor pulls, and go-kart races.

The study determined that facilities along the levees should focus on motorboating and fishing, the activities for which there is currently large demand (nearly half of all people recreating in the Delta engage in motorboating and/or fishing). Clifton Court Forebay facilities should focus on fishing and nonmotorboating activities. The study concluded with a look at 17 proposed facilities and their estimated facility costs, design day load capacities, and estimated number of annual recreation days. The proposed facilities were divided into four development classes: Class A – Basic Fishing Access, Class B – Moderately Developed Fishing Access, Class C – Highly Developed Recreation Area, and Class D – Regional Level Recreation Area. By dividing the estimated annual use (in recreation days) found in Table II-9 by the estimated facility cost found in Table II-8, the facility with the greatest number of annual recreation days per dollar spent is the S. Fork Mokelumne River Fishing Access, a Class A – Basic Fishing Access facility.

A Study of Boater Recreation on Lake Berryessa, California

The study provides a summary of survey data collected at Lake Berryessa in the summer of 1998.

Description of Boaters and Their Use of Lake Berryessa

Most boaters had a significant number of years of boating experience. The study distinguishes between boaters who use the marinas and those who use the boat ramps. Ramp boaters visited the lake an average of 21 days per year while marina users boated 40 days per year on average. Ramp users typically boated for a single day while marina boaters typically visited for two or more days. A large majority of boaters in both groups lived within 15 miles of the lake. Ramp users placed more emphasis on experiencing the outdoors in an undisturbed natural setting. Marina boaters sought more opportunity to socialize in the scenic outdoor setting.

Boater Perceptions of and Preferences for Conditions

Boaters listed both their most favorite locations on the lake and those most likely to be avoided due to overcrowding. Good water quality, calm water, beautiful scenery, and lake size were cited as the most attractive features associated with the lake's setting. Boaters also cited several problems with boating on the lake, including undesirable boats or boating and unsafe and discourteous boaters. Boaters chose Lake Berryessa primarily for the closeness and convenience to their permanent homes or summer homes. Good water quality and scenery were described as better at Lake Berryessa. Positive changes noticed by boaters included higher and/or more consistent water level followed by improvements to facilities and services.

Perceptions and Estimated Use Levels

Boating traffic appeared to be somewhat reduced during the 1998 season due to an unusual period of cool, rainy weather. About 24% of the marina boaters and 46% of the ramp users indicated that they saw more boats than they wanted to on the lake. Boats numbered from 493 to 538 on weekends and 90 to 188 on weekdays.

Suggestions for Using Data

In addition to the data collected and analyzed, the report also made the following suggestions as to how the data could be used:

- Increase and improve lower-density and dispersed camping opportunities
- Coordinate with law enforcement personnel
- Increase boater education and visitor information services
- Prohibit exclusive uses of various coves and areas around the lake
- Develop partnerships for more effective and efficient lake management
- Provide additional short-term lodging (hotels and motels)
- Create limits on boat speed, size, and horsepower
- Increase public access to shoreline (Jackson 1998).

Poe Hydroelectric Project Recreation Studies

Several background recreation reports were prepared for the Poe Hydroelectric Project. These reports discuss recreation on the North Fork Feather River (NFFR) and are listed as follows:

- *Recreation Supply Analysis*
- *Recreation Demand Analysis*
- *Recreation Needs Analysis*
- *Recreation Capacity and Suitability Analysis*
- *Recreation Visitor Survey Report*
- *Whitewater Boating Assessment Report*

The *Recreation Supply Analysis* identifies recreation sites and facilities in the region, as well as those located along the NFFR in the Poe Project Study Area. The *Recreation Demand Analysis* identified statewide and project-wide trends that are predicted to affect recreation in the project area. Butte County population is projected to increase in population 92 percent by the year 2035. Annual visitation is expected to increase 94 percent in the Poe Project Area by 2035. Recreation visitor days are expected to increase 72 percent by 2035 in the Poe Project Area.

The *Recreation Needs Analysis* identified that the four dispersed sites have existing facilities that could be improved. No new sites were identified as being needed during the next license period.

The *Recreation Capacity and Suitability Analysis* identified the maximum level of use for the four dispersed recreation sites as well as the river segment and reservoir in the Poe Project Area. The average utilization for Day Use Areas and Campgrounds is within acceptable limits (under 40 percent). Peak use on several summer weekends reached 64 percent, which is also an acceptable level. The primary concern is to have adequate parking and other facilities for these brief, peak periods.

The *Recreation Visitor Survey Report* summarizes visitor habits in the Poe Project Area. The majority (88 percent) of recreationists visited their chosen site (over 50 percent at Sandy Beach) for the day only; 12 percent of visitors camped, primarily at Bardees Bar. The top three activities were swimming/wading, resting/relaxing, and beach use/sunbathing.

The *Whitewater Boating Assessment Report* describes the results from a controlled flow study with whitewater boaters on the NFFR. Median flows on the NFFR are typically less than 100 cubic feet per second (cfs); however, boatable flow is from 500 to 2000 cfs. Approximately 24 days per year are considered boatable based on gauge data. Surveys of the whitewater participants indicated that a majority of boaters would return to the river if flows were high enough (between 500 to 1450 cfs) (PG&E 2002).

Upper North Fork Feather River Project Recreation Study (Volume 3 of 8)

This report (1,268 pp.) covers existing recreation opportunities and facilities in the Upper North Fork Feather River (UNFFR) project vicinity as well as in the region. The project vicinity covers Lake Almanor, Butt Valley Reservoir, and 22 miles of the upper reaches of the NFFR, including the Poe Project Area. The following topic areas are covered in the Upper NFFR report:

- Existing Recreational Opportunities and Facilities
- Existing and Potential Recreation Use and Needs Analysis
- Agency Recommended Measures
- Recreation Proposals

- Responsible Parties, Schedules, and Costs for Implementing Measures and Proposals
- National Wilderness Areas, Wild and Scenic Rivers; and Trails
- Economic Impacts of Lake Almanor and Project Recreation Resources

Recreators in the UNFFR Project Area were surveyed. The UNFFR report also draws on the 1998 DPR Survey and the 1999 Cordell report to project future demand. Those reports are summarized under their own heading. Demand is expected to increase for swimming, beach use, picnicking, biking, and developed camping from 2000 to 2035. Population for the state of California is expected to grow 57.2 percent by the year 2035 (PG+E 2002). The topic areas pertinent to the R-12 – *Projected Recreation Use* report are summarized below.

The Existing Recreational Opportunities and Facilities topic area includes the Regional Recreation Assessment as well as the Recreation Facility Condition and Site Inventory. These studies describe the seven campgrounds, six day use areas, and 22 commercial and private resorts at Lake Almanor. There are two campgrounds and one boat launch and picnic area. There are also three campgrounds and one rest stop along the two river reaches included in the Project area. Most of the facilities are in good condition. The regional recreation assessment describes several areas that have similar recreation resources including the LOSRA and Oroville area. Comparisons are also given for reservoir- and river-related sites based on the number of developed facilities. Demand for activities statewide and projected demand for selected activities in the Project area are also discussed. It was concluded that there is little latent demand in the Project area.

The *Existing and Potential Recreation Use and Needs Analysis* topic area includes the Questionnaire Survey, Projected Recreation Use Analysis, and Recreation Needs Analysis Synthesis. The most popular activities in the Project area include fishing, swimming, sightseeing, and wildlife viewing. Most visitors to the Project area felt that either Lake Almanor or Butt Valley Reservoir was their favorite area. About 50 percent of Belden Reach respondents felt the Belden Reach was their favorite area. Survey respondents were fairly evenly split about their preference for “natural and undeveloped areas” and “developed nature-oriented parks.”

Popular reasons for visiting the UNFFR Project area include that the area is special to them, the area is quiet and peaceful, scenery, camping, and that the area is easily accessible. Most visitors felt that the area was not at all crowded, although respondents felt slightly crowded on the water. Shoreline access, low water level, and high cost to use facilities were the main issues mentioned in the surveys and focus groups. The Projected Use study projects how much activities in the UNFFR Project area will grow in the coming years, drawing on the 1998 DPR Survey and the 1999 Cordell report to project future demand. Those reports are summarized under their own heading. Demand is expected to increase for swimming, beach use, picnicking, biking, and

developed camping from 2000 to 2035. Projections when facilities will hit carrying capacity were also done based on occupancy rates. The role of the Project area within the region was also discussed. The Needs Analysis identified possible facility improvements or additions for camping, day use/picnicking, boating, swimming, interpretation and education, trail, fishing, open space, and whitewater boating facilities.

LAKE OROVILLE AREA RECREATION REPORTS

Lake Oroville Recreation Authority Recreation Plan, 2001

The Lake Oroville Recreation Authority (LORA) *Recreation Plan* provides advocacy for recreation facility/economic development for the Lake Oroville area. The document, created by Oroville community members, outlines funding and planning needs and calls for infrastructure improvements at various places throughout the LOSRA and OWA. LORA members argue that many of these projects should be completed under the existing license and not be delayed into the next license period. The plan identifies the Joint Powers Authority, primarily under the City of Oroville and Feather River Recreation and Parks District leadership, as an alternative to DPR's management of recreation facilities at Lake Oroville and the Thermalito Reservoirs.

Table A-1 lists LORA-proposed projects that may be relevant to Oroville Facilities Relicensing recreation studies (LORA 2001).

Table A-2. Proposed LORA projects.

LORA-Proposed Project	Location	Suggested Project Type	LORA Plan pp.
Craig Access Road Improvement	From Lumpkin Road to Craig Park	Road Improvement	21
Potter's Ravine Access Road	From the top of the dam to Cherokee Road	Road construction	22
South Forebay	Grand Avenue access	Restrooms and utilities	22
South Forebay	Nelson Avenue access	Restrooms and utilities	23
Power Canal	Tres Vias Road/Grand Avenue	Bridge construction	23
Thermalito Afterbay	Monument Hill access	Restrooms and utilities	24
Thermalito Afterbay	Larkin Road access	Restrooms and utilities	24
Native Plant Nursery	Undetermined	Native plant nursery for environmental rehabilitation	25
Hamilton Cemetery Rehabilitation	Historic Hamilton Ranch	Cultural preservation	26
Historic and Cultural Museum	Potentially North Forebay	Museum construction	27 to 28
Diversion Pool	Various	Trail improvement, utilities, gate install, boat ramp install, plus others	30–32
Thermalito North Forebay	Various	Picnic area, beach, swimming area improvement, wildlife studies	33–35

Table A-2. Proposed LORA projects.

LORA-Proposed Project	Location	Suggested Project Type	LORA Plan pp.
Thermalito South Forebay	Various	New grandstand, shade plantings, restrooms, and additional picnic tables	35
Thermalito Afterbay	Various	Improved fishery, new RV park, parking improvements, stabilized water levels, improved signage	37–39
Equestrian Facility Improvements	Lakeland Boulevard and other locations	Acquire land for equestrian center and develop parking, signs, trails, rental stables etc. Parking improvement, replace water trough, designate pedestrian bridge for multi-use, connect trails	39–46
Bike Trail Improvements	Overlaps with equestrian facility projects	Road widening, trail improvements, etc.	47–50

Source: LORA 2001.

Resource Management Plan and General Development Plan, Lake Oroville State Recreation Area, 1973

This report is the General Plan for this unit of the State Park System, adopted by the California Parks and Recreation Commission. It also describes the various natural resources at Lake Oroville including geology, climate, hydrology, soils, slope, vegetation, wildlife, and scenic and cultural resources. Descriptions of each recreation area summarize the relationship between the natural resources and potential recreation development. Capacity of each area, and existing and potential recreation developments are also discussed (DPR 1973). The Plan was amended in 1993 to accommodate changes proposed for the Lime Saddle Area.

Proposed Amended Recreation Plan for Lake Oroville State Recreation Area, 1993

The *Proposed Amended Recreation Plan* outlines existing facilities as well as potential additional improvements and new facilities such as picnic tables, parking campsites and boat ramp upgrades at various locations. This plan also includes a description of fish and wildlife resources, the local area, economic considerations, and LOSRA user patterns. It was intended to supersede Bulletin 117-6 as the contemporary and official Recreation Plan for Project 2100. Various attachments include a chronology of events leading to the Amended Recreation Plan, comments on the amended plan, and a review of existing facilities. FERC issued an order approving the plan in 1994 with additional provisions.

FERC Order on Revised Recreation Plan, 1994

This order, No. 2100-054 issued September 22, 1994, stipulates that in addition to the *Proposed Amended Recreation Plan*, general additional recreational facilities and programs must also be implemented. The order called for additional facilities at Lime Saddle, Thermalito Afterbay, South Thermalito Forebay, and along the Feather River.

Oroville Reservoir Thermalito Forebay, Thermalito Afterbay Water Resources Recreation Report, Bulletin No. 117-6

This broad and comprehensive report outlines a potential plan for development of recreation facilities at Lake Oroville. This report projected that visitation would increase by approximately one million visitors per decade, starting at approximately 750,000 the first year that the project was to be completed (1968). The report outlines potential specific site plans and numbers of parking spaces, campsites, etc. for each recreation site (DWR 1968).¹ It was forwarded to FERC in 1977 when FERC requested a recreation plan, though DWR did not intend it to be construed as a final development plan.

Trail Logbooks

Trail logbooks are provided by DPR and local equestrians. The trail logbooks are kept as a record of comments by visitors to equestrian trails in the LOSRA. Included are comments on weather, the satisfaction of visitors, notes to other riders, ruminations, and poems. Trail logbooks were reviewed from several years from the 1990s to the present.

Butte Sailing Club Statistical Data – 2001

There are three parts to the *Butte Sailing Club Statistical Data* document. The first part is a record of the number of visitors attending Aquatic Center activities from November 1999 to September 2001. The second part of the data relates to boating counts. It is a record of the number of boats that participated in sailing events sponsored by the club. The date of the event, the number of boats, and their location are recorded for non-rained-out events beginning December 12, 1987, and continuing through the end of the year 2001. The document also describes an instructional program. The third section contains literature on the Butte Sailing Club's Basic Instruction program as well as a record of the number of students enrolled in this program during the years 1991 to 2001.

Graph 1 (not reproduced here) shows the number of sailboats per year between 1988 and 2001 that attended sailing events on Lake Oroville, including the North Forebay and the Afterbay. After plunging in 1998 from higher levels in 1990, 1991, 1996, and 1997, sailboat turnout leveled off for 1999, 2000, and 2001.

¹ The projected use numbers do not match actual user numbers which have been approximately 650,000 (and declining) for each decade since the project was built. Demand did not justify full buildout of all potential recreation sites and "initial" facilities.

Graph 2 (not reproduced here) shows the number of sailboats that participated in boating events on Lake Oroville (including the Afterbay and North Forebay) by season for the years 1988 to 2001. The graph shows that for the years 1990, 1991, 2000 (tied with spring) and 2001, summer had the most boats at events. For most other years (1988, 1989, 1992–97, and 1999), fall/winter had the highest sailboat turnout. As in Graph 1, Graph 2 shows the decline in the number of sailboats that have turned out for events on Lake Oroville since 1998. Only in the fall/winter of 1999 and summer of 2001 has boater turnout been near pre-1998 levels.

Graph 3 (not reproduced here) is a plot of the number of sailboats that participated per day for sailing events at Lake Oroville (including Thermalito Afterbay and North Forebay) versus Lake Almanor. From 1992 to 2000, Lake Almanor has had substantially more sailboats turn out per day for events than Lake Oroville.

Graph 4 (not reproduced here) shows the total number of sailboats that participated in sailing events at several locations each year from 1988 to 2001. Locations include Lake Oroville (including Thermalito Afterbay and North Forebay), Collins Lake, Eagle Lake, Gold Lake, Lake Almanor, and Little Grass Valley Reservoir. Several of the lakes shown only had a small number of sailboats turn out a few times for events. Collins Lake and Gold Lake only had sailboats turn out for events in 1 of the 14 years shown (1991 and 1992, respectively). Eagle Lake and Little Grass Valley Reservoir have only had sailboats turn out for sailing events in two of the fourteen years shown (1991 and 1995, and 1988 and 1989, respectively). Lake Oroville and Lake Almanor have had the largest total numbers of sailboats turn out for each of the 14 years shown.

Lake Oroville State Recreation Area Attendance Data 1974-2001

Lake Oroville has had dramatically varying levels of attendance from 1974 to the present. Official data are reported by Fiscal Year (FY), July 1 to June 30. Figures were first compiled in FY 1974-75, with attendance of 677,398 visitor-days. Data tables and charts presenting this data are provided in Attachment A of Appendix B to Study Report R-12 – *Projected Recreation Use*. Attendance dropped slightly in FY 1976-77 and then started rising yearly until hitting a peak in FY 1980-81 with 953,192 visitors, the highest recorded attendance in the data set. Within 2 years, attendance was at a low of 321,274 visitors, a 66 percent drop in attendance. The next year, attendance increased more than twofold to 713,823 visitors.

There was less variation for the following six year period (1985-86 through 1990-91). Attendance dropped about 20 percent in FY 1991-92 to 477,166 visitors and then went back up the next year to 626,178 visitors. Attendance steadily climbed to another peak of 777,819 visitors in 1995-96, about a 60 percent increase from the 1991-92 low (a drought period). This peak, however, was still about 20 percent less than the attendance peak in FY 1980-81. After the FY 1995-96 peak, attendance began to decline and then dropped significantly in FY 1997-98 to 472,301 visitors (a 40 percent drop from the FY 1995-96 peak) and leveled off for the next two years. The year FY

2000-01 saw an even larger drop in attendance, hitting a low for this data set at 266,509 visitors. This was a drop of 45 percent from the year before and a 66 percent drop from the peak in FY 1995-96.

Specific sites within the Lake Oroville area have also had variable attendance patterns. The North Forebay, with a relatively stable surface elevation, followed the Lake Oroville State Recreation Area (LOSRA) attendance patterns with a few exceptions. After a peak in attendance in FY 1990-91, attendance began to decline at the North Forebay; however, LOSRA attendance was increasing and eventually peaking in FY 1995-96. Another exception occurred in FYs 1998-99 and 1999-2000 when attendance rose at the North Forebay, while overall LOSRA attendance was dropping.

Besides peaks in FY 1980-81 (28,993) and FY 1981-82, (31,694) attendance at the South Forebay was approximately 15,000 visitors from FYs 1984-85 to 1996-97. Since FY 1997-98, attendance at the South Forebay has dropped off to under 10,000 visitors annually.

The highest attendance in the data set for Loafer Creek was in FY 1974-75 (160,101). After this peak, attendance dropped and then surged again in the late 1970s and early 1980s. Loafer Creek attendance was low in FY 1983-84 (49,119) but increased the next year, as did overall LOSRA attendance. Generally, attendance levels have not been as high for the mid 1980s and 1990s as they were for the late 1970s and early 1980s, except for the years FY 1995-96 (681,297) and FY 1996-97 (717,106). For Loafer Creek, FYs 1990-91 and 1991-92 were very low attendance years but were not low attendance years for LOSRA. Also, attendance was consistent in FYs 1999-2000 and 2000-01, while LOSRA attendance saw a sharp decline between these two years.

Unlike Loafer Creek, where attendance levels have declined since the mid-1980s, attendance levels at Spillway have increased since the late 1980s. Attendance has remained at about 100,000 visitors for the late 1980s and most of the 1990s, except for a drop in FY 1991-92, which was also a drop for LOSRA attendance. Attendance only hit 100,000 visitors three times between FYs 1974-75 and 1986-87. However, attendance only dropped below 100,000 visitors once between FYs 1987-88 and 1996-97. Since FY 1997-98, attendance has dropped well below 100,000 visitors to under 50,000 visitors were recorded in 2000-01 but this is in part due to protracted construction projects there.

Bidwell Canyon, site of one of two marinas on Lake Oroville, has also seen an increase in attendance levels. Attendance has increased in the 1990s from the 1970s and 1980s. Attendance peaks were higher for LOSRA in the 1980s than in the 1990s; whereas the reverse is true for Bidwell Canyon, which had much higher peaks in the 1990s than the 1980s.

At Lime Saddle, site of Lake Oroville's second marina, attendance levels during the 1990s were roughly half of what they were for parts of the late 1970s and mid- to late 1980s. Attendance fluctuated between 100,000 and 140,000 visitors during the late 1970s and mid- to late 1980s. Attendance has been between 40,000 and 60,000 visitors since then, until a significant drop below 20,000 visitors in FY 2000-01. No significant peaks in attendance have occurred at Lime Saddle since FY 1990-91.

Car-top boat ramps, boat-in camps, and Enterprise BR all had a significant surge in attendance in 1980-81, the same year that LOSRA attendance peaked. Enterprise BR and Car-top boat ramps doubled their attendance that year, and boat-in campsites tripled in attendance. Car-top boat ramps had higher attendance levels in the late 1970s and 1980s than in the 1990s. Attendance hovered around 30,000 visitors in the 1970s and 1980s but dropped to around 20,000 visitors for the 1990s until a sharp decline in FY 1997-98. Boat-in camps have had a drop in attendance levels since the late 1970s and 1980s. There was high attendance at boat-in camps from FY 1984-85 through FY 1986-87 with around 12,000 visitors. Since FY 1987-88, attendance has dropped to between 2,000 and 4,000 visitors, except lows in FY 1990-91 and FY 1991-92 of less than 400 visitors.

As prescribed by FERC order 2100-054, DWR has collected and biennially reported attendance data since 1995. Reported attendance data is based on DPR attendance data and, more recently, on traffic data from a network of counters that DWR has installed. The reports give attendance figures for several areas within the LOSRA and OWA, comparison to capacity, and a review of the traffic counter program. DWR has sought to refine the efficiency of the traffic counter system each year to increase accuracy. These biennial attendance reports are available on the FERC website; they are typically filed in March (no later than April 1) of odd-numbered years.

Summer Camper Survey – Lake Oroville SRA, 1981

The purpose of this survey, conducted by DPR in 1981, was to find out who uses Lake Oroville and how LOSRA operations may be changed to better meet the needs and wants of users. A visitor profile was compiled along with visitor likes, dislikes, satisfaction, and suggestions, as well as demographic data such as type of accommodation, mode of travel, economic background, age, traveling partners, expenditures, and length of stay.

The survey was conducted by uniformed Park Aids in a State vehicle between the hours of 9:00 a.m. and 2:30 p.m. between the dates of June 1 and August 1, 1981. The majority (75%) of completed surveys were conducted on the weekends. Altogether, 262 people either participated in personal interviews or returned the survey. Most of the visitors interviewed were campers, so results are not generalized with other recreation activity groups. Surveys were conducted at the Loafer Creek Campgrounds and Day Use Area, Bidwell Canyon Campgrounds and Marina, and North Forebay Day Use Area.

The survey found that most visitors came to the lake to relax (88%). Both water and shore activities were very popular, including swimming, motorboating, water skiing, sunbathing and enjoying the beach while picnicking, frisbee throwing, or relaxing. Fishing was also a common activity, mainly for bass and trout.

The most common attraction of Lake Oroville by far was the lake itself, followed by cleanliness of area and facilities. The most common dislike was water loss at Lake Oroville, followed closely by campsites located too far from the lake or beach.

Visitors were also questioned about their needs and desires. The most common desire was a snack bar or store at campground areas. Sports facilities were also a common desire, such as another horseshoe area, tennis and basketball courts, and a dance or recreation hall. The top five visitor suggestions were for the following amenities: laundry facilities, an ice machine, a dock or mooring area at Loafer Creek, more restrooms at campsites, and more shower facilities.

Visitors tended to travel by car, pickup, or camper and spend at least one night in the park either camping or in a motor home or camper. Most campers came with family, friends, or as a couple. The survey also found that the majority of visitors (73%) traveled 51 miles or more to visit Lake Oroville (DPR 1981).

Lake Oroville State Recreation Area, Recreational Use Study, 1997

Chico State University, under contract from the California Department of Water Resources, conducted this survey to determine the number of recreation days occurring at each site within LOSRA and at Thermalito Afterbay. The study had several other purposes beyond determining the number of recreation days. These included determining the specific activities being participated in, the length of visit, multipliers to convert car count data to recreation days, the most reasonable method for meeting FERC-ordered attendance data collection requirements, the amount of money spent by users per recreation user day, how much money was spent in the local area, visitor origin, visitor satisfaction level, and whether visitors desired additional facilities and/or recreation opportunities.

Attendance data from 1991 to 1994 from the Department of Parks and Recreation (DPR) were used as a starting point to divide the year into three seasons: high, medium, and low attendance. The high attendance season included the months between Memorial Day to Labor Day (the end of May, June, July, August, and the beginning of September). The medium attendance season included the months of March, April, May (until Memorial Day weekend), September (after Labor Day), and October. The low attendance season encompassed the remaining months of the year: November, December, January, and February. Since the study did not begin until the medium attendance season, no data were collected for the low attendance season. The study was conducted on 33 dates during the 1996 recreation season. The four

locations with the highest use—Bidwell Canyon, Spillway, Lime Saddle, and Loafer Creek—received continuous data collection. Five days of continuous data collection were conducted at Monument Hill and North Forebay in addition to periodic data collection visits. At sites without high use, roving use counts were conducted. In addition, 1,628 questionnaires were collected from visitors at several sites between April 22 and September 21, 1996 (between 8:00 a.m. and 8:00 p.m.). These questionnaires provided information on the visitor and their group, household, and visit.

The study found that Bidwell Canyon and Spillway accounted for about 40 percent of the LOSRA total visitor days and about \$3.1 million of the over \$5.6 million in total local expenditures, making these two sites by far the most-used locations at Lake Oroville.

The study also looked at participation by season. During the summer, 50 percent of respondents visited at least once per week and less than 2 percent of respondents did not go at all, making summer the season with the highest participation. Winter had the least amount of participation with about 55 percent of respondents not participating at all during the season. Besides resting and picnicking, the top activities were water related: fishing from boats, waterskiing, pleasure boating, and swimming/wading. Over half of the respondents participated with their family or a group of family and friends. Visitor satisfaction was found to be very high with about 93 percent of users stating they were satisfied or very satisfied with their experience, about 98 percent would recommend/strongly recommend LOSRA to a friend, and over 99 percent planned to return to the area.

Users were also asked about their desire for new or additional facilities. At least 48 percent of respondents rated as a high priority the following four items: security patrols in parking lots, enforcement of laws, stocking more fish, and more shore access for fishing and swimming. These four items did vary some by location, possibly due to differences in activities at each location. The only item to receive about 50 percent response of no priority was having hotels and motels near LOSRA. Comments by respondents also included the following: clean the debris out of the lake, add more lake patrols, clean the toilets, keep the non-fee areas, maintain maximum Afterbay water levels on the weekends, and add more sandy beaches (Guthrie 1997).

DEMOGRAPHIC STUDIES

Managing Outdoor Recreation in California: Visitor Contact Studies 1989–1998

This report by Deborah Chavez states that resource and park managers in California will have various ethnic group visitation at their sites and the variety of visitors may have different needs than the managers are currently prepared to meet. The first step is to know the demographics, value systems, and patterns of visitation to recreation sites (Chavez 1998).

Chavez lists several recommendations for resource managers in general. Hispanic outdoor recreators tend to convene in larger than average groups and may be more spontaneous than other visitors. The recommendations listed may also be applicable to recreation areas that draw on Hispanic populations in the future and are summarized as follows:

- Managers should provide as many developed features as is feasible (toilets, group facilities, large tables in group configurations, etc.).
- Managers should be mindful that they are providing more than land management; they are providing social experiences and providing outlets for personal growth and family bonding.
- Most outdoor recreation sites are built for a smaller group size of four to six, renovations or new construction can be built to suit larger groups.
- Many visitors may not plan their outings and managers may want to consider how to provide recreation opportunities and amenities for those visitors (Chavez 2001).

The Role of Population Projections in Environmental Management

California and other regions in the United States are becoming more populated and ethnically diverse, and thus, ecological impacts on the wildland-urban interface are a significant policy concern. In a socioeconomic assessment focused on the geographic regions surrounding four national forests in southern California, population projections are being formulated to assist in the update of forest plans. In Southern California, the projected trend of explosive population growth combined with increased ethnic and racial diversity indicates challenges for environmental management. First, patterns of recreation use on wildlands are likely to change, and management of these areas will have to address new needs. Second, as land management agencies face changing constituencies, new methods of soliciting public involvement from various racial groups will be needed. Third, growth in the region is likely to encroach upon wildland areas, affecting water, air, open space, and endangered species. Fourth, in order to address all these concerns in a climate of declining budgets, resource management agencies need to strengthen collaborative relationships with other agencies in the region. How environmental managers approach these changes has widespread implications for the ecological sustainability of forests in Southern California.

Recent demographic trends indicate that the most concentrated population growth is shifting away from coastal/metropolitan areas and towards the Central Valley and Inland Empire counties.

The projected increase in urban sprawl and the number of commuters will increase traffic congestion and related impacts such as air pollution, traffic accidents, and the consumption of natural resources for highway expansion and construction.

Ethnic groups differ in recreation preferences such as group size, participation motives, attitudes toward natural resources, facility preferences, communication preferences, and levels of participation (Struglia 2002).

Changes in Demographics: Changes in Recreation Patterns

This report examines socio-demographic shifts and their impacts upon outdoor recreation participation and projections. The report presents results of two cross-sectional studies, one conducted in 1992 and a follow-up conducted in 1997. White and Hispanic respondents' data were compared, indicating that more white people than Hispanics had heard of particular activities such as natural history and hiking. More white people than Hispanics had tried most of the activities, although many Hispanics had tried mountain biking. Most respondents from both groups thought they might try these activities in the future (Chavez 2001).

Invite, Include, and Involve! Racial Groups, Ethnic Groups, and Leisure

This report discusses the changing demographic profile of the U.S. toward a more racially diverse population. The report defines the difference between the terms *race* and *ethnic*. *Race*, as a sociological term, denotes a group of people who perceive themselves and are perceived by others as possessing certain distinctive and hereditary traits. An *ethnic group* is based on perception of cultural differences. An ethnic group is a group of people who perceive themselves and are perceived to share cultural traits such as language, religion, family customs, and preferences in food. These terms do not necessarily indicate homogeneity even with a group.

This report asserts that Hispanic and Asian recreators tend to participate in outdoor recreation activities in large groups. Beyond group size, the type of recreation activities engaged in differ among groups (Chavez 2000).

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APPENDIX B

RECREATION VISITATION MODELS

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INTRODUCTION

This report summarizes the development of a set of recreation visitation models, using multiple regression techniques, for estimating recreation attendance at the Oroville Facilities as part of Study R-12 – *Projected Recreation Use*. Following this Introduction, the report consists of two components: (1) methodology and (2) modeling results. The methodology section describes the analytical approach and statistical techniques used to develop the regression models that can be used to estimate recreation use at Lake Oroville and Thermalito Forebay (the Forebay) under different resource conditions¹. These models quantitatively describe the relationship between attendance levels (i.e., recreation use) in the Project area and a range of factors that potentially influence recreation use levels. The modeling results section summarizes these quantitative relationships in terms of their magnitude and statistical significance.

In addition to the steps described below for estimating the recreation visitation models for Lake Oroville and the Forebay, the relationship between visitation and recreation facilities at Lake Oroville, the Forebay, and at other similar reservoirs will be evaluated. The purpose of the evaluation is to develop an understanding of this relationship to assess the effects on recreation visitation within the Project area of potential protection, mitigation, and enhancement (PM&E) measures involving new recreation facilities being considered for the new license and settlement agreement.

METHODOLOGY

The methodology used to develop the recreation visitation models is organized into eight tasks. These tasks generally follow sequential order, but are not necessarily mutually exclusive (i.e., several tasks occurred simultaneously using the results of one task to help guide another task), and have been identified to better understand the progression of tasks in the modeling process. In the context of this particular work effort, the eight tasks are:

- **Task 1:** Assemble and Review Attendance Data
- **Task 2:** Assess Potential Models to Fit the Attendance Data
- **Task 3:** Assemble Data for Explanatory Variables
- **Task 4:** Conduct Regression Analysis to Identify a Base Model (including Functional Form)
- **Task 5:** Test Alternative Variables with the Base Model to Improve Model Fit
- **Task 6:** Test Temporal Consistency of the Data
- **Task 7:** Select a Set of Expanded Models and a Preferred Model
- **Task 8:** Perform Diagnostic Tests for Autocorrelation in the Preferred Model and Develop Model Corrections, as Necessary

¹ Historical data were not available to develop regression models for estimating recreation use at other locations within the FERC boundary, including Thermalito Afterbay, Oroville Wildlife Area, and the Feather River.

In addition to completing these tasks for developing models for estimating annual visitation, a monthly model was developed subsequently for Lake Oroville to potentially evaluate in-season effects of changes in lake levels on visitation

TASK 1: ASSEMBLE AND REVIEW ATTENDANCE DATA

Estimating recreation use at Lake Oroville and the Forebay using regression models was based on statistical analysis of historical (time series) data. The key variable of interest was the level of attendance at project facilities, which was considered the *dependent variable* in the model. Several sources of attendance data for Lake Oroville were reviewed, including official estimates from the Department of Water Resources (DWR) and estimates previously compiled for DWR reports.

Official DWR estimates are available on a fiscal year basis (July through June) for the period 1974-75 to 2000-01 (DWR 2001) (see Attachment A for data tables and charts of attendance over time). The fiscal year (FY) estimates were developed by compiling daily use data at the various park units into monthly estimates, which were then aggregated into annual FY estimates. Park units in the official estimates for the Lake Oroville State Recreation Area (LOSRA) include: North Forebay, South Forebay, Loafer Creek, Spillway, Bidwell Canyon, Lime Saddle, Car-top Boat Ramps, Enterprise, Boat-In Camps, Craig Saddle, Diversion Pool, Parrish Cove, Loafer Creek Horse Camp, Floating Campsites, Visitor Center, and the Clay Pit SVRA². The OWA falls within the Project boundary although it is not a part of the LOSRA.

Data were not available for all sites for the entire period of record (FY 1974-75 through FY 2000-01). Specifically, no data were available for the Boat-In Campsites during 1974-75; no data were available for the period 1974-75 to 1978-79 for Craig Saddle, Diversion Pool, and Parrish Cove; data for the Loafer Creek Horse Camp and the Floating Campsites were only available for fiscal year 2000-01, and data for the Clay Pit SVRA were available for 1994-95 and 1996-97 to 2000-01. For the analysis, data for the Clay Pit SVRA were excluded from the dataset because use of this site is not believed to be influenced by lake level, which is a key *explanatory or independent* variable in the models.

Attendance data at Lake Oroville also were available from a report prepared by DWR entitled *Recreation Facilities of the State Water Project: An Inventory, Central District* (1992). Data from this study are available for the years 1968–91 and are presented on a calendar year, as opposed to a fiscal year, basis.

² Recreation sites that were included in the Lake Oroville model are those located on the main reservoir, and therefore, exclude the Forebay, Diversion Pool, and Clay Pit SVRA.

TASK 2: ASSESS POTENTIAL MODELS TO FIT THE ATTENDANCE DATA

The next step in the analytical process was to assess which potential model types, in terms of source and structure of the attendance data, would best explain changes in recreation use over time at Lake Oroville. Three potential model types were considered: (1) monthly–seasonal; (2) annual–calendar; and (3) annual–fiscal.

A monthly–seasonal model was considered because data collected during the peak recreation season (i.e., May–September) reflect actual counts of visitors at most locations, which is the most reliable data for modeling purposes; data for non-peak periods are estimated based on established seasonal trends and field observations. However, complete monthly data are not available for the entire study period (1974-2000) or for all of the recreation sites, so developing a monthly model that explains variations in total visitation at Lake Oroville was not feasible.

An annual–calendar year model also was considered based on the availability of calendar year attendance data from the 1992 DWR report referenced in Task 1. A calendar year model is preferred over a fiscal year model because data for some of the independent (explanatory) variables are in calendar year form, thereby ensuring consistency between the variables in the model. In addition, calendar year data coincide with water year classifications, allowing for an analysis of the relationship between the type of water year and attendance. Although this dataset is appealing for the statistical analysis because the data do not overlap two recreation seasons, potentially inconsistent methods were used to compile the data. Consequently, it was concluded that use of this dataset for the statistical analysis was inappropriate.

Lastly, the annual–fiscal year model is based on official DWR attendance data, which is tracked on a fiscal year basis. The benefits of this type of model are that it represents the most complete and current data set available and provides information by park unit. The limitations of this model are that attendance estimates (dependent variable) may not be in the same form as selected explanatory variables (e.g., unemployment data are available in calendar-year form only), and attendance data cross over two separate water year types. Even with these limitations, the annual–fiscal year model, which would utilize the most current data available, was considered the preferred modeling approach. For the annual–fiscal year model, two attendance variables were developed for both the Lake Oroville and Forebay models:

- **Oro_Att:** Lake Oroville fiscal year attendance at all recreation sites, excluding the North and South Forebay, Diversion Pool, and the Clay Pit SVRA.
- **Oro_Att_PC:** Lake Oroville fiscal-year attendance at all recreation sites, excluding the North and South Forebay, Diversion Pool, and the Clay Pit SVRA area, on a per capita basis. A weighted population factor based on visitor origin obtained from visitor surveys was used to derive the per capita estimates of use (see Attachment B).
- **Frbay_Att:** North and South Forebay fiscal year attendance levels.

- **Frbay_Att_PC:** North and South Forebay fiscal year attendance levels, on a per capita basis. A weighted population factor based on visitor origin obtained from visitor surveys was used to derive the per capita estimates of use (see Attachment B).

TASK 3: ASSEMBLE DATA FOR EXPLANATORY VARIABLES

The explanatory or independent variables in a regression model are intended to represent major factors that influence the dependent variable, which in this case, is attendance at Lake Oroville and the Forebay. The selection of explanatory variables was based on a review of other recreation use models, knowledge about the project area, and availability of data. Seven general categories of explanatory variables were considered in the development of the model:

1. Water conditions
2. Substitute sites
3. Demographics
4. Economic conditions
5. Travel cost
6. Climate
7. Recreation trends

For each of these categories, a set of potential variables were defined. These categories and associated variables are described below. The descriptive statistics of the full suite of model variables is included as Attachment C.

Water Conditions

Water conditions (i.e. lake elevation levels) at Lake Oroville are expected to be a prominent factor influencing attendance levels. Generally, as water levels decrease below certain levels, the ability to recreate (e.g., launch a boat) and the quality of the recreational experience diminish. Lake elevation data for Lake Oroville were obtained from the California Data Exchange Center (Reservoir Data/Reports). Based on average monthly elevation data, several lake elevation variables were constructed, including:

- **ORO_el:** Oroville average annual fiscal year elevation (based on monthly averages);
- **ORO_el5:** Oroville average seasonal elevation for the months July–June;
- **ORO_el3:** Oroville average seasonal elevation for the months July–Sept;
- **ORO_el_J:** Oroville average monthly elevation for July; and
- **ORO_el_d:** Oroville elevation drop between monthly averages for July and September.

Substitute Sites

Recreation quality at substitute sites also may influence attendance levels at Lake Oroville. The recreation user surveys conducted at the Oroville Facilities (Study R-13 – *Recreation Surveys*) identified other reservoirs that visitors to Lake Oroville commonly visit; these facilities are considered substitute sites to recreating at Lake Oroville. The top three substitute reservoir sites are Lake Almanor (24 percent), Shasta Lake (18 percent), and Folsom Lake (16 percent). Lake elevation data for these three sites obtained from the California Data Exchange Center were used to construct variables that are intended to reflect the relative attractiveness of these sites compared to Lake Oroville. These variables are:

- **ALM_rat:** Ratio between the average annual fiscal year storage as a percent of total capacity at Lake Oroville divided by the average annual fiscal year storage as a percent of total capacity at Lake Almanor;
- **SHA_rat:** Ratio between the average annual fiscal year storage as a percent of total capacity at Lake Oroville divided by the average annual fiscal year storage as a percent of total capacity at Shasta Lake; and
- **FOL_rat:** Ratio between the average annual fiscal year storage as a percent of total capacity at Lake Oroville divided by the average annual fiscal year storage as a percent of total capacity at Folsom Lake.

Demographics

Demographic variables considered in the model include several types of population estimates, ethnicity, and age. Changes in population would affect the potential visitor base that recreate at Lake Oroville. In addition, the ethnicity and age of the population may also affect the types of recreation opportunities sought by the potential visitor base. Demographic data for California counties and the state as a whole were obtained from the California Department of Finance. The following demographic variables were developed:

- **Pop_ca:** Annual population estimates for California, as of July 1 of each year;
- **Pop_ncl:** Annual population estimates for northern California counties, as of July 1 of each year;
- **Pop_butte:** Annual population estimate for Butte County, as of July 1 of each year;
- **Eth_wht:** Weighted percentage of population that is White;
- **Eth_hsp:** Weighted percentage of population that is of Hispanic origin; and
- **Age_55:** Weighted percentage of population that is age 55 or older.

Economic Conditions

A range of economic indicators was considered to account for economic conditions that may affect recreation use levels. A positive economic climate and higher disposable income among potential visitors are likely to induce more participation in leisure

activities. Economic indicators considered include per capita personal income and unemployment, for which data were obtained from the Bureau of Economic Analysis (BEA) and the California Employment Development Department (EDD), respectively. The economic indicator variables were defined as follows:

- **PCI_CA_A:** Per capita personal income for California (adjusted to 2000 dollars using the Consumer Price Index [CPI]). Data available on calendar year only;
- **PCI_Butte_A:** Per capita personal income for Butte County (adjusted to 2000 dollars using the CPI). Data are available on calendar year only;
- **UE_CA_U:** Unemployment rate in California (not seasonally adjusted). Used fiscal year average; and
- **UE_Butte_U:** Unemployment rate in Butte County (not seasonally adjusted). Data are available on calendar year only.

Travel Cost

The cost of traveling to recreation sites has been shown to affect whether recreation-oriented trips are undertaken. The cost of travel is dependent on many factors, including gasoline prices. Gasoline price data were collected from the California Energy Commission, and are intended to serve as a proxy for travel cost. The following travel cost variable was developed:

- **Gas_CA:** Annual average gas prices, including taxes (adjusted to 2001 dollars using the CPI).

Climate

Climate-related factors also are believed to affect recreation use. Above- or below-average temperature or precipitation could be expected to negatively affect water-oriented recreation use, which constitutes an important component of Lake Oroville's recreation base. Temperature and precipitation data were collected from the Western Regional Climate Center. Where historical monthly data were not available, monthly averages were used for missing data. Temperature was considered to be a more appropriate factor influencing attendance because most recreation use occurs in the summer months when little or no precipitation occurs; however, precipitation data also were evaluated. Several different temperature variables were constructed:

- **Temp_max:** Average fiscal-year maximum temperature;
- **Temp_5:** Average seasonal maximum temperature for July–June;
- **Temp_3:** Average seasonal maximum temperature for July–Sept;
- **Temp_2lg:** Average seasonal maximum temperature for May and June of preceding FY;
- **Temp_ave:** Average monthly temperature for the FY;
- **Temp_ave_3lg:** Average monthly temperatures for April, May, and June of preceding FY;

- **Prec_ave:** Average monthly precipitation for the FY; and
- **Prec_ave_3lg:** Average monthly precipitation for April, May, and June of the preceding FY.

Recreation Trends

Finally, general recreation trends may affect recreation use levels at Lake Oroville over time and were considered for inclusion in the model. Because there is no single variable that could directly capture such a broad effect, a variable was developed based on the year of observation. By controlling for other factors that may influence attendance levels, such a variable serves as a proxy for recreation trends over time. This variable was defined as follows:

- **Year:** Year of observation (1 through 26)

In addition, information on boat registrations, fishing license sales, and fish stocking programs were evaluated in conjunction with the trend variable (Year) to analyze recreation trends that are specific to use patterns at Lake Oroville. These variables were defined as:

- **Boat_reg:** Weighted average of number of registered pleasure boats by county (used population weighting factor to derive weighted average). Data are available on calendar year only.
- **Fsh_lic:** Weighted average of number of annual fishing licenses sold by county (used population weighting factor to derive weighted average). Data are available on calendar year only.
- **Fish_stk:** Total number of salmonid fish species stocked at Lake Oroville. Data are available on calendar year only.
- **Fstk_lag:** Total number of salmonid fish species stocked at Lake Oroville lagged by one year. Data are available on calendar year only.

Excluded Variables

One important explanatory variable that was not considered in the Lake Oroville recreation model is the condition and capacity of recreation-related facilities. It is intuitive that as additional or improved facilities are developed and capacity expands to accommodate additional visitors, attendance levels typically increase. The history of facility development at Lake Oroville, however, is such that no development or expansion of facilities was undertaken until the early 1990s. Prior to then, facility capacity was roughly constant since the development of the Project in the early 1960s. Because there is not sufficient variation in facility condition or capacity over time, this factor cannot be controlled for in the recreation visitation model for Lake Oroville.

TASK 4: CONDUCT REGRESSION ANALYSIS TO IDENTIFY A BASE MODEL

Regression analysis is a statistical technique used to explain quantitatively the relationship between two or more variables. For this analysis, Statistical Package for the Social Sciences (SPSS) software was used to identify a base recreation model for Lake Oroville. The base model represents the core dependent and independent variables that are critical to the model, both in terms of modeling efficiency and in being able to evaluate the effects of changes in resource conditions on recreation use in the Project area. The base model also identifies the most appropriate functional form of the regression equation.

Developing the base recreation model was based, in part, on past recreation modeling efforts for Lake Oroville, which were part of a larger modeling effort for the environmental impact statement/environmental impact report (EIS/EIR) on the Central Valley Project Improvement Act (CVPIA) program in the mid-1990s (U.S. Department of the Interior 1997). That model estimated attendance levels to be a function of lake elevation and population only. Therefore, these two explanatory variables were used as a starting point in developing the model. Preliminary runs for the current model indicated a negative relationship between population and attendance levels, which was not expected based on previous modeling results for Lake Oroville. As explained above, one would expect attendance levels to increase with a larger population base that could recreate at Lake Oroville. Because population levels have steadily increased since 1974, it was deduced that the population variable could in fact be picking up the effects of recreation trends in declining use over time. The year variable was included in the model simultaneously with the population variable to control for recreation trend effects; however, these two variables are highly correlated (correlation coefficient=.998), which led to multicollinearity in the model. Multicollinearity means that two or more of the explanatory variables in a regression model are highly correlated, making it difficult or impossible to isolate their individual effects on the dependent variable. With multicollinearity, the estimated coefficients may be statistically insignificant (and even have the wrong sign) despite a relatively high R-squared, which represents the “goodness of fit” of the model. Consequently, the population variable was subsequently shifted (to the left side of the equation) to calculate a new dependent variable, visits per capita (using a weighted population factor), and the year variable was considered as an explanatory variable to capture recreation trend effects.

Initial model runs were not robust, resulting in low R-squared values and coefficients on variables that were unexpectedly insignificant. This prompted further review of the attendance dataset, which resulted in the discovery of anomalies in the data. One anomaly of particular interest was the extremely low attendance data for the FY 1983-84 and unusually low attendance in FYs 1997-98 and 1998-99 at Lake Oroville and between FY 1997-98 and FY 1999-00 at the Forebay. These anomalies were investigated by contacting staff at DWR, the Department of Parks and Recreation (DPR), and the Department of Forest and Fire Prevention (major fire was mentioned as a possible reason), in addition to closely evaluating climatic conditions for particularly

unusual weather conditions during that fiscal year and the preceding months. The only reason identified by DPR (Preston, personal communication, 2003) for the extremely low attendance in FY 1983-84 was the possible failure of mechanical devices that were used for collecting vehicle count data at the time. Because of the particularly unusual nature of the attendance data for FY 1983-84, a dummy variable initially was used to control for this observation in the base models. Dummy variables are variables that mark or encode a particular attribute, and unlike continuous variables, dummy variables take on a value of 0 or 1 depending whether that attribute is present. Dummy variables also were subsequently tested for certain years in the late 1990s when attendance was unusually low and could not be explained by the data. These variables were defined as follows:

- **DV_8384:** Observation occurring in FY 1983-84
- **DV_9798:** Observation occurring in FY 1997-98
- **DV_9899:** Observation occurring in FY 1998-99
- **DV_9799:** Observation occurring in FY 1997-99
- **DV_97aft:** Observation occurring in FYs 1997-98 through 2000-2001 (Forebay model only)

Subsequent to the preliminary model runs, it was concluded that the data for FY 1983-84 represented an outlier to the dataset and was excluded from future modeling runs. In addition, because there was no rationale to control for low attendance data in the late 1990's, the other dummy variables were not considered for future analysis.

Functional Form

The next consideration in the development of the base model was functional form. The functional form of a multiple regression model is an important consideration in developing the best-fitting model and in interpreting modeling results. Several common functional forms were tested for the Lake Oroville and Forebay recreation visitation models, including linear, linear-log, log-linear, and log-log. Details on each of these functional forms are provided below.

Linear: $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k + u$

The linear function is usually considered to be the benchmark and the default functional form. It is generally used whenever there is no reason to believe any particular functional form is most appropriate. Note that the slope is constant but the elasticity is not. Interpretation: $\Delta y = \beta_1 \Delta x$ (a one unit increase in x results in a change in y of β_1).

Linear-Log: $y = \beta_0 + \beta_1 \log(x)$

This is sometimes called the “logarithmic” function. For multiple regression models, any subset of the x 's can be logged while leaving others in linear form, implying that one can

model a nonlinear relationship between y and some of the x 's and a linear relationship between y and other x 's. All observations of the x variable must be positive since the log is undefined for zero and negative numbers. Interpretation: $\Delta y \approx \frac{\beta_1}{100} (\% \Delta x)$ (a one percent increase in x results in a change in y of approximately $\beta_1/100$).

Log-Linear: $\log(y) = \beta_0 + \beta_1 x$

This is sometimes called the “exponential” function. For multiple regression models, this functional form implies a nonlinear relationship between y and all of the x 's. All observations of the y variable must be positive since the log is undefined for zero and negative numbers. Interpretation: $\% \Delta y \approx (100 \beta_1) \Delta x$ (a one unit increase in x results in a change in y of approximately $(100 \beta_1)$ percent).

Log-log: $\log(y) = \beta_0 + \beta_1 \log(x)$

This is sometimes called the “power” function. It is linear in the logarithms and the constant elasticity function, because the elasticity is everywhere equal to β_1 . All observations of the x and y variables must be positive since the log is undefined for zero and negative numbers. Interpretation: $\% \Delta y \approx \beta_1 (\% \Delta x)$ (a one percent increase in x results in a change in y of approximately β_1 percent).

All of the functional forms described above are linear in the parameters, but not necessarily linear in the variables. This fact allows modeling of certain kinds of nonlinear relationships (i.e., logarithmic) using linear regression methods (Ordinary Least Squares [OLS]). Nonlinear regression techniques are also available for models that are nonlinear in the parameters, but they are more difficult to use.

Elasticity concepts are helpful in interpreting alternative functional forms and also in determining the correct functional form to use in a regression analysis. Elasticity measures the responsiveness of changes in a dependent variable to changes in an independent variable in percentage terms. Elasticities are useful because they are invariant to units of measurement and are therefore easy to interpret. The elasticity of y with respect to x is the percentage change in y associated with a one percent change in x . The appeal of the *log-log* functional form is that the coefficient estimates represent elasticities. However, by taking the natural log of the dependent variable, you restrict the range of variability in that variable, which may result in inefficiencies when simulating past and estimating future recreation use. Therefore, it was desirable to keep the dependent variable (attendance levels) in linear form. The *linear-log* functional form was tested and provided a good fit for the model.

In summary, the base model for Lake Oroville and the Forebay are characterized by the following attributes:

- Functional Form: Linear-log
- Dependent Variable: Oro_Att_PC / Frbay_Att_PC
- Independent Variables: Year and Oro_el

TASK 5: TEST ALTERNATIVE VARIABLES WITH BASE MODEL TO IMPROVE MODEL FIT

After the base models were identified, additional variables were added to the base set of explanatory variables to determine whether they improved the robustness of the model. The evaluation process focused on retaining variables that are statistically significant and increase the explanatory power (R-squared) of the model. The selection of additional model variables was based on consistency with recreation demand theory, accepted recreation demand principles, and knowledge of the recreation area. The general rule of thumb was to exclude variable combinations with a correlation coefficient of 0.8 or higher (this rule was relaxed in the case of the dummy and interactive variables that were developed as part of the structural stability testing in Task 6; please refer to Task 6 below for more information). A complete correlation matrix is included as Attachment D.

Various combinations of variables from the general categories described above were entered into the multiple regression models. By evaluating R-squared values, which represents the overall explanatory value of a set of explanatory variables, and p-values³ for individual explanatory variables, which represents the statistical significance of coefficient values, an expanded set of explanatory variables was identified.

This process indicated that the only additional variable appropriate for inclusion in either of the two models was a travel cost variable (i.e., gas prices) in the Forebay model. The other sets of variables, including substitute sites, economic indicators, and climate conditions, either did not improve the fit of the base models or did not meet significance criterion, and thus were not included in the expanded base model. Miscellaneous model runs for variables that were not included in the final models are included as Attachment E.

TASK 6: TEST TEMPORAL CONSISTENCY OF THE DATA

Based on a review of the recreation attendance data and the results of preliminary modeling efforts, it was concluded that the recreation model may be affected by temporal inconsistency. Temporal inconsistency refers to a model with parameters (both the coefficients and error term) that vary across observations of the sample. In other words, different sub-samples of the dataset (in this case, different time periods) produce significantly different results in terms of coefficient estimates and precision of the model. If parameters change at a particular point in time, one would expect such a

³ The threshold of significance for inclusion of variables in the model was a p-value of 0.1 (a 90 percent significance level).

point to correspond to particular events, such as changes in policy or simply random, identifiable events. Because there is no single event that serves as rationale for temporal inconsistency in the Oroville and Forebay models, structural break tests were conducted over a range of potential break points using the Chow test statistic. The Chow test involves comparing the residual sum of squares between the full time-series data and sub-samples of the data to determine whether at least one of the coefficients is different across the sub-samples.

The results of the Chow tests indicated that there are significant structural breaks in both the Oroville and Forebay models at the 1 percent significance level. The strongest break in the Oroville model occurs between FYs 1980-81 and 1981-82, while the strongest break in the Forebay model occurs a year earlier, between FYs 1979-80 and 1980-81.

To address the issue of temporal inconsistency in the models, dummy and interactive variables were created using the location of the break in the dataset. The following variables were developed and tested in the Oroville model:

- **DV_8081:** Observations occurring after FY 1980-81 (i.e., 1981-82 and after).
- **IV_elev:** Interactive variable between the dummy variable at the break point (DV_8081) and lake elevation (Oro_el).
- **IV_gas:** Interactive variable between the dummy variable at the break point (DV_8081) and gas prices (Gas_ca).
- **IV_igyr:** Interactive variable between the dummy variable at the break point (DV_8081) and natural log of the year of the observation (Year). The natural log of the Year (trend) variable was used to develop this interactive term because it is more plausible to assume that recreation trends over time would not be constant. This is important because the recreation use models may be used for estimating future recreation use, particularly in the context of evaluating project alternatives at a future point in time (2020) in the Preliminary Draft Environmental Assessment (PDEA).

A comparable set of variables were developed for the Forebay model, including:

- **DV_7980:** Observations occurring after FY 1979-80 (i.e., 1980-81 and after).
- **IVf_elev:** Interactive variable between the dummy variable at the break point (DV_7980) and lake elevation (Oro_el).
- **IVf_gas:** Interactive variable between the dummy variable at the break point (DV_7980) and gas prices (Gas_ca).
- **IVf_igyr:** Interactive variable between the dummy variable at the break point (DV_7980) and the natural log of the year of the observation (Year).

Various combinations of the dummy and interactive variables were tested in conjunction with the base model to determine if the overall explanatory power of the model (R-

squared) and significance of the coefficients improved. In implementing these new variables, a high degree of collinearity among certain of the new variables was detected. Strict interpretation of the procedure for screening out collinear variables (i.e., 0.8 or higher) was relaxed in this task due to the improved predictive capability gained by including these new variables. Because multicollinearity only affects the precision and significance of individual explanatory variables (not the overall predictive capability of the model), collinearity that involved specific variables of interest that are affected by policy decisions in the context of relicensing, namely lake elevation levels, was still not allowed in model.

TASK 7: SELECT A SET OF EXPANDED MODELS AND A PREFERRED MODEL

The selection of a set of expanded recreation visitation models for Lake Oroville and the Forebay was based on several criteria that gauge the robustness of the models. This set of models was evaluated in the context of three main criteria:

- **Adjusted R-Squared.** Models must have an adjusted R-squared value of 0.60 or higher. This value is somewhat arbitrary, but provides a way of differentiating models based on the overall fit of the models to the data. One published study cites that an adjusted R-squared over 50 percent is acceptable for recreation demand models (Loomis and Walsh, 1997).
- **P-Values.** All coefficient estimates must have a p-value of 0.1 or less. In other words, all explanatory variables must be statistically significant at the 90 percent confidence level.
- **Multicollinearity.** The model must not be subject to multicollinearity affecting the policy variables (i.e., lake elevation) or variables that will be allowed to vary (i.e., recreation trends) in the simulation modeling tasks. The threshold for correlation among variables is 0.8.

The set of expanded models for Lake Oroville and the Forebay are identified in Attachments F and G, respectively. To select a preferred model for each recreation area, the predictive capability of these models was evaluated along with consideration of how the models would be used in the relicensing process (e.g., estimating recreation use levels associated with different project alternatives in the PDEA). The evaluation of the predictive capability of the models consisted of using the parameter estimates from the modeling results and past values for the set of explanatory variables to see how well the predicted values match the actual attendance levels during the period 1974-75 to 2000-01. By comparing predicted and actual values associated with model alternatives, one can gauge the predictive capability of the model, as well as determine if there are any systematic patterns in the predictive model (e.g., over-predicting and/or under-predicting attendance levels based on type of water year).

The predictive capability of the models was evaluated by comparing predicted versus actual attendance values in the context of various lake-level conditions and over the study period as a whole. Lake-level conditions were organized into three types: (1) Low (<800 feet); (2) Moderate (800-850 feet); and (3) High (>850 feet). This approach to evaluating the predictive capability of the models is consistent with how the models will be used for comparative analysis (i.e., evaluating the effects of different operational scenarios under different types of water years such as dry, normal, and wet).

TASK 8: PERFORM DIAGNOSTIC TESTS FOR AUTOCORRELATION IN THE PREFERRED MODEL AND DEVELOP CORRECTIONS, AS NECESSARY

As a final step to ensure statistical credibility of the model, diagnostic tests of the preferred models were performed to check the model for autocorrelation. Autocorrelation arises when the residual error term in one time period is positively correlated with the residual error term in another time period. Typically, this correlation occurs between observations in one time period and the previous time period; this is referred to as positive first-order autocorrelation, and is common in time-series datasets. Its implication for regression analysis is that it leads to downward-biased standard errors, and thus to incorrect statistical tests and confidence intervals (note that the OLS parameter estimates remain unbiased and consistent). The presence of first-order autocorrelation is tested using the Durbin-Watson statistic.

The Durbin-Watson statistic for the Lake Oroville and Forebay models are 1.623 and 1.276, respectively. Based on the significance points (5 percent level of significance) associated with the Durbin-Watson statistic for the Oroville model ($d_l=1.22$ and $d_u=1.55$), one can accept the null hypothesis that there is *no* first-order autocorrelation in the model. In the Forebay model, the significance points associated with the Durbin-Watson statistic are $d_l=1.14$ and $d_u=1.65$; therefore, one can neither accept nor reject the null hypothesis that there is no autocorrelation in the model. Because the null hypothesis cannot be rejected, it cannot be concluded that there is autocorrelation in the Forebay model. Because autocorrelation was not detected in either model, there was no need to correct for this problem through the use of variable transformations.

DEVELOPMENT OF MONTHLY RECREATION USE MODELS

As mentioned above, a monthly model also was developed for Lake Oroville to potentially evaluate in-season effects of changes in lake levels on visitation. Although initial efforts included estimating a monthly model for both Lake Oroville and the Forebay, preliminary results indicated that developing a monthly model was viable only for Lake Oroville.

Developing the monthly model for Lake Oroville included many of the same tasks as described above for the annual models. However, the monthly model focused on a much shorter historical time period (1995–2000) based on the limited availability of monthly data. Monthly data for this time period were obtained through official reports ("Summary of Attendance Data - Technical Information Record") transmitted to FERC

by DWR on a regular basis. In addition, the monthly model was based on visitation data only for the peak recreation season months (June through September) during this timeframe, and concentrated on several units that comprise the Lake Oroville recreation area: Loafer Creek, Spillway, Bidwell Canyon, and the Boat-In Campsites. Generally, these months and sites are perceived as those with the most reliable attendance data.

The definition of the regression equation for the preferred monthly model is more straightforward than for the annual model. The equation is a *linear-log* model that consists of a lake elevation variable (defined in the same manner as in the annual model) and a set of dummy variables that correspond to the months analyzed⁴.

MODELING RESULTS

As described above, separate annual recreation visitation models were developed for the Lake Oroville area (which includes the main reservoir and portions of the upstream tributary reaches) and the Thermalito Forebay area (including North Forebay and South Forebay); a monthly model also was developed for Lake Oroville. Separate models were developed for these two recreation areas because they possess distinct characteristics in terms of project operations, namely that the Forebay is subject to only minor fluctuations in water elevation levels relative to Lake Oroville, where lake level is a primary factor that influences visitation. Because understanding the relationship between lake elevation levels and recreation use in the project area is an important consideration in estimating future recreation use, it was important to distinguish these two recreation areas as they may be affected differently by lake levels. Note that the Lake Oroville water elevation variable is included in the Forebay models based on the substitutability of these two recreation areas. A summary of the results of the preferred annual and monthly models for these two recreation areas and an evaluation of the predictive capability of these models are presented below. Detailed statistical output for the Lake Oroville and Forebay models is presented in Attachments F and G, respectively.

INTERPRETATION OF MODELING RESULTS

The recreation use models are represented by a regression equation which provides coefficient estimates for all of the explanatory variables and a constant (intercept) term. The coefficient estimates demonstrate the magnitude of the relationship between the dependent and explanatory variables. Each coefficient estimates has an associated t-statistic (and corresponding p-value) that denotes the statistical significance of the coefficients associated with the individual explanatory variables. Generally, t-values greater than two indicate that the coefficient for a particular variable is statistically significant (i.e., different from zero) at the 95 percent confidence level. Conversely, p-values demonstrate the confidence level at which a coefficient is statistically significant.

⁴ Although there are four months during the peak-recreation season, only three dummy variables are included in the model to avoid perfect multicollinearity; the dummy variable corresponding to the month of July was omitted from the model.

For example, a p-value of 0.05 indicates that the coefficient is statistically significant at the 95 percent confidence level. The higher the confidence level (or lower the p-value), the stronger the relationship between the explanatory and dependent variable. Depending on the purpose of the study, confidence levels greater than 90 percent are typically considered to be statistically significant.

The best-fitting functional form for all of the recreation models is the *linear-log* model. The interpretation of variables in a *linear-log* model is presented in the model results below. It should be noted that not all of the explanatory variables are in natural log form (e.g., dummy variables remain in linear form).

LAKE OROVILLE RECREATION MODEL (ANNUAL)

The recreation visitation model for Lake Oroville evaluates recreation attendance in relation to a set of explanatory variables identified through the implementation of Tasks 1 through 8 as described above. The preferred model for explaining visitation at Lake Oroville was a *linear-log* regression equation as specified below (t-values are in parentheses).

$$\text{ORO_ATT_PC} = -19.055 + 3.229 (\text{L_ORO_EL}) - 0.345 (\text{IV_LGYR})$$

(-3.45) (3.92) (-9.41)

where:

- **ORO_ATT_PC** is the fiscal-year attendance at key recreation sites at Lake Oroville (main reservoir) on a weighted per capita basis. The weighted population factor is based on visitor origin data derived from current visitor use surveys;
- **L_ORO_EL** is the average lake level at Lake Oroville during the July through June fiscal year (in natural log form); and
- **IV_LGYR** is an interactive variable that explains the time trend on visitation (in natural log form) since 1980-81 (i.e., with the use of a dummy variable that takes on a value of 1 for the years 1981-82 and after).

The F-Statistic, which explains the overall significance of the model, is 54.41, and is significant at the 99 percent confidence level (p-value=0.000). Therefore, it can be concluded that this set of explanatory variables does explain variation in the dependent variable (attendance at Lake Oroville). The adjusted R-squared, which denotes how well the overall model fits the data, is 0.81 and indicates that roughly 81 percent of the variability in annual attendance at Lake Oroville is explained by the two variables and the constant value (intercept). The coefficient estimates, statistical significance, and

interpretation of each of the explanatory variables are presented below. The signs on all of the coefficients are intuitively plausible.

As expected, there is a positive relationship in the lake elevation levels (**L_ORO_EI**) and attendance at Lake Oroville. Higher lake levels often result in more and higher quality recreation opportunities for visitors. This coefficient estimate is statistically significant at the 99 percent confidence level (p-value=0.001). The interpretation of the estimate on this variable is that a one percent increase in the average lake level (e.g., from 800 feet above mean sea level [msl] to 808 feet msl) during the July through June fiscal year at Lake Oroville would result in a 0.03229 unit increase in per capita attendance levels at Lake Oroville, holding all else constant. Using a weighted population level of 381,691 persons (2000), this is equal to an increase of 12,325 visitors at Lake Oroville.

The coefficient estimate on the only other explanatory variable, **IV_LGYR**, is negative and statistically significant at the 99 percent confidence level (p-value=0.000). Because this variable represents an interactive term and is entered into the model without including the interacted term **L_YEAR**, this variable indicates that there is a negative trend downward in recreation attendance in the period FY 1981-82 to FY 2000-01; it does not explain the effect of recreation trends prior to the break point (i.e., FY 1974-75 to FY 1980-81). In other words, as the year of the observation increases after FY 1981-82, there would be lower recreation visits at Lake Oroville, holding all else constant. Based on the coefficient estimate, this decline is about 13,170 annual visitors when moving from year 20 (FY 1993-94) to year 22 (FY 1995-96), which is a 10 percent increase in the value of the observation. Because this variable is in natural log form, the rate of this downward trend is decreasing over time. This variable can be used to evaluate recreation visitation under different assumptions concerning recreation trends.

As shown in Attachment F, the overall difference in actual versus predicted attendance is -0.34 percent, meaning that the model tends to slightly over-predict recreation attendance over the historical study period. The predictive capability of this model is relatively stronger under high water conditions (-0.49 percent difference) compared to low water conditions (1.00 percent) and moderate water conditions (-1.29 percent). In general, there does not appear to be a systematic relationship between over- or under-prediction of the model based on lake-level conditions.

FOREBAY RECREATION MODEL (ANNUAL)

The Forebay recreation model exhibits a similar structure to the Lake Oroville model. The preferred model for explaining visitation at the Forebay was a linear-log regression equation as specified below (t-values are in parentheses).

$$\text{FRBAY_ATT_PC} = 3.127 - 0.424 (\text{L_ORO_EL}) - 0.0979 (\text{IVF_LGYR})$$

(2.20) (-2.00) (-6.124)

$$+ 0.163 (\text{IVF_GAS}) \\ (6.19)$$

where:

- **FRBAY_ATT_PC** is the fiscal-year attendance at North and South Forebay recreation areas, on a weighted per-capita basis. The weighted population factor is based on visitor origin data derived from current visitor use surveys;
- **L_ORO_EL** is the average lake level at Lake Oroville during the July through June fiscal year (in natural log form); and
- **IVF_LGYR** is an interactive variable that explains the time trend on visitation (in natural log form) since FY 1979-80 (i.e., with the use of a dummy variable that takes on a value of 1 for the FYs 1980-81 and after).
- **IVF_GAS** is an interactive variable that explains the effect of gasoline prices since FY 1979-80 (i.e., with the use of a dummy variable that takes on a value of 1 for the years 1980-81 and after).

The F-Statistic for this model is 14.19. Therefore, it can be concluded that the set of explanatory variables do explain variation in the dependent variable (attendance at the Forebay area) at the 99 percent confidence interval (p-value=0.000). The adjusted R-squared is 0.61 and indicates that roughly 61 percent of the variability in annual attendance at the Forebay is explained by the three variables and the constant value (intercept).

In the Forebay model, there is a negative relationship between lake elevation levels (**L_ORO_EL**) and attendance at the Forebay. This result is intuitive in that higher lake levels draw visitors away from the Forebay to recreate at Lake Oroville, or conversely that lower lake levels drive visitors away from Lake Oroville to recreate at the Forebay. In other words, the Forebay can be viewed as a substitute recreation opportunity for activities at Lake Oroville. This relationship is statistically significant at roughly the 95 percent confidence level (p-value=0.058). The interpretation of the estimate on this variable is as follows: a one percent increase in the average lake level at Lake Oroville would result in a 0.00424 unit decrease in per capita attendance levels at the Forebay, holding all else constant. Using the current (2000) weighted population level, this is equal to a decrease of 1,618 visitors at the Forebay.

Similar to the Lake Oroville model, the interactive term **IVF_YR** is negative and statistically significant at the 99 percent confidence level (p-value=0.000). Likewise, this variable enters the regression equation without the interacted term **YEAR**; therefore this variable suggests that there is negative trend downward in recreation attendance at the Forebay during the period FY 1980-81 to FY 2000-01, but does not provide

information on recreation trends prior to that break point. The interpretation on this variable is that moving from year 20 (FY 1993-95) to year 22 (FY 1995-96), which technically is a 10 percent increase in the value of the observation, would result in a decline of approximately 3,740 annual visitors at the Forebay, holding all else constant. Again, because this variable is in natural log form, the rate of this downward trend is decreasing over time. This variable can be used to evaluate recreation visitation under different assumptions concerning recreation trends.

Lastly, the interactive term **IVF_GAS** is positive and statistically significant at the 99 percent confidence level (p-value=0.000). This variable represents the effect of gas prices on Forebay attendance for the period FY 1980-81 to FY 2000-01; it does not provide information on gas price effects prior to that break point. During this latter period, gas prices have had a positive relationship with Forebay attendance, which is not necessarily intuitive because as travel costs increase, one might expect recreation use levels to decline. However, in the case of the Forebay (and Lake Oroville), this result is plausible because many visitors to the area are local residents, and as gas prices increase, people may elect to recreate locally instead of traveling to other recreation areas further away. The interpretation of the coefficient estimate on this variable is as follows: a one-tenth unit increase in the average annual gas prices (in constant dollars) (i.e., a 10 cent increase or going from \$1 dollar per gallon to \$1.10 dollars per gallon) during the period FY 1980-81 and after would result in an increase of approximately 6,222 visitors at the Forebay, holding all else constant.

As shown in Attachment G, the overall difference in actual versus predicted attendance in the Forebay model is -6.25 percent, meaning that the model tended to over-predict recreation attendance over the historical study period. The predictive capability of this model is substantially better under low water conditions (-1.81 percent difference) and high water conditions (1.84 percent) compared to moderate water conditions (-16.27 percent). The relatively large difference in actual versus predictive values under moderate water conditions reflects unusually low attendance in FY1997-98 and FY1998-99, which could not be explained by DWR and DPR staff. Similar to the Lake Oroville model, there does not appear to be a systematic relationship across water conditions in terms of over-prediction and/or under-prediction of visitation by the model.

LAKE OROVILLE RECREATION MODEL (MONTHLY)

The preferred monthly model for explaining visitation at Lake Oroville was a *linear-log* regression equation as specified below (t-values are in parentheses).

$$\begin{aligned} \text{ORO_M_PC} = & -3.675 + 0.576 (\text{L_ORO_EL}) - 0.0955 (\text{DV_JUNE}) \\ & (-2.96) \qquad (3.14) \qquad (-5.49) \\ & - 0.0274 (\text{DV_AUG}) - 0.0895 (\text{DV_SEPT}) \\ & (-1.53) \qquad (-4.73) \end{aligned}$$

where:

- **ORO_M_PC** is the attendance at selected recreation sites at Lake Oroville (i.e., Loafer Creek, Spillway, Bidwell Canyon, and the boat-in campsites), for the months July through September, on a weighted per capita basis. The weighted population factor is based on visitor origin data derived from current visitor use surveys;
- **L_ORO_EL** is the average monthly lake level at Lake Oroville for the months June through September (in natural log form);
- **DV_JUNE** is a dummy variable that takes on a value of 1 for observations in June and 0 otherwise.
- **DV_AUG** is a dummy variable that takes on a value of 1 for observations in August and 0 otherwise.
- **DV_SEPT** is a dummy variable that takes on a value of 1 for observations in September and 0 otherwise.

The F-Statistic, which explains the overall significance of the model, is 15.43, and is significant at the one percent confidence level (p-value=0.000). Therefore, it can be concluded that this set of explanatory variables does explain variation in the dependent variable (visitation during the peak recreation season at selected sites at Lake Oroville). The adjusted R-squared, which denotes how well the overall model fits the data, is 0.72 and indicates that roughly 72 percent of the variability in seasonal attendance at Lake Oroville is explained by the four variables and the constant value (intercept). The coefficient estimates, statistical significance, and interpretation of each of the explanatory variables are presented below. The signs on all of the coefficients are intuitively plausible.

As expected, there is a positive relationship in the lake elevation levels (**L_ORO_EL**) and visitation during the peak recreation season at selected sites at Lake Oroville. This coefficient estimate is statistically significant at the 99 percent confidence level (p-value=0.005). The interpretation of the estimate on this variable is that a one percent increase in the average monthly lake level (e.g., from 800 feet above mean sea level [msl] to 808 feet msl) during the peak recreation season at Lake Oroville would result in a 0.00576 unit increase in per capita attendance levels at selected sites at Lake Oroville, holding all else constant. Using a weighted population level of 381,691 persons (2000), this is equal to an increase of 2,199 visitors during the peak recreation season at the four selected sites.

The coefficient estimates on the other three explanatory variables, **DV_JUNE**, **DV_AUG**, and **DV_SEP**, are negative, but only **DV_JUNE** (p-value=0.000) and **DV_SEP** (p-value=0.000) are statistically significant at the 99 percent confidence level; **DV_AUG** (p-value=0.142) is not statistically significant at any reasonable confidence level. Because these variables represent the relative seasonal effect of the month of the observation compared to the month of July (omitted from the model), the negative values indicate that recreation visitation during the months of June and September tend to be lower, on average, than visitation in July. There is no statistical difference between recreation visitation in July and August. These results are considered intuitive because July and August are in the middle of the peak recreation season and would be expected to have higher visitation. Based on the coefficient estimates and a weighted population level of 381,691 persons (2000), the relative difference in attendance levels, (compared to July) is about 36,450 fewer visitors in June and about 34,160 fewer visitors in September, holding all else constant.

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APPENDIX B

ATTACHMENT A – LAKE OROVILLE SRA ATTENDANCE

Table B.a-1. Official Lake Oroville SRA Attendance (FY 1974-75 through FY 2000-01)																											
Park Unit	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01
North Forebay 151A	46,882	41,017	52,888	59,161	79,058	67,787	98,205	101,564	84,703	39,127	85,524	66,042	76,241	67,145	69,767	70,205	107,862	90,296	85,054	83,031	59,253	57,125	53,064	26,098	37,797	50,876	64,873
South Forebay 151B	6,953	4,562	3,975	10,905	16,686	18,916	28,993	31,694	9,874	7,046	15,609	12,916	16,120	18,986	7,549	13,418	18,600	17,590	14,859	13,308	13,213	14,844	14,960	8,640	6,265	6,945	19,902
	7.95%	6.59%	11.07%	11.60%	13.06%	9.90%	13.34%	17.23%	16.77%	14.37%	14.17%	13.23%	14.03%	13.33%	13.23%	13.77%	21.18%	22.61%	15.96%	14.13%	10.11%	9.25%	9.58%	7.35%	8.45%	10.86%	12.69%
Loafer Creek 151C	160,101	105,911	65,600	76,611	130,181	110,408	134,750	122,778	94,536	49,119	91,469	61,374	62,786	63,241	54,430	55,659	14,401	10,379	34,365	50,726	55,935	92,488	83,073	41,241	89,848	101,679	74,571
	23.63%	15.32%	12.78%	12.69%	17.75%	12.60%	14.14%	15.87%	16.76%	15.29%	12.81%	10.28%	9.54%	9.79%	9.32%	9.17%	2.41%	2.18%	5.49%	7.44%	7.80%	11.89%	11.70%	8.73%	17.23%	19.09%	11.16%
Spillway 151D	97,889	96,793	100,871	72,640	140,534	124,214	91,460	90,447	61,169	24,337	60,768	49,097	55,914	102,770	127,003	108,461	149,241	77,237	112,206	123,308	174,505	200,479	140,645	70,238	72,729	60,209	91,698
	14.45%	14.00%	19.64%	12.03%	19.17%	14.18%	9.60%	11.69%	10.84%	7.58%	8.51%	8.23%	8.50%	15.90%	21.74%	17.86%	24.99%	16.19%	17.92%	18.09%	24.33%	25.77%	19.80%	14.87%	13.94%	11.30%	13.73%
Bidwell Canyon 151E	108,752	105,627	64,724	42,510	72,985	119,276	125,512	144,487	104,760	50,493	107,485	70,554	104,953	83,140	74,284	89,630	136,913	131,558	174,277	198,946	227,702	219,904	198,716	152,753	116,181	144,345	167,491
	16.05%	15.27%	12.60%	7.04%	9.95%	13.61%	13.17%	18.68%	18.57%	15.72%	15.06%	11.82%	15.95%	12.87%	12.71%	14.76%	22.93%	27.57%	27.83%	29.18%	31.75%	28.27%	27.98%	32.34%	22.27%	27.10%	25.08%
Lime Saddle Marina 151F	80,378	82,006	34,260	50,226	95,181	140,413	116,965	69,336	39,565	39,781	151,296	125,959	123,536	133,296	104,418	110,191	33,299	37,121	50,994	63,906	48,746	58,045	51,829	33,730	57,558	36,533	35,555
	11.87%	11.86%	6.67%	8.32%	12.98%	16.03%	12.27%	8.96%	7.01%	12.38%	21.20%	21.11%	18.77%	20.63%	17.87%	18.15%	5.58%	7.78%	8.14%	9.37%	6.80%	7.46%	7.30%	7.14%	11.03%	6.86%	5.32%
Cartop Boat Ramps 151G	20,668	29,359	18,109	28,333	24,462	39,288	84,917	26,828	12,578	15,890	27,588	31,582	31,798	15,799	14,875	18,092	12,271	8,530	18,978	21,512	23,007	23,624	24,723	9,845	9,976	8,355	61,619
	3.05%	4.25%	3.53%	4.69%	3.34%	4.48%	8.91%	3.47%	2.23%	4.95%	3.86%	5.29%	4.83%	2.44%	2.55%	2.98%	2.06%	1.79%	3.03%	3.16%	3.21%	3.04%	3.48%	2.08%	1.91%	1.57%	9.23%
Enterprise 151H	6,516	8,080	3,823	7,190	10,490	14,100	29,235	8,635	4,010	4,233	12,235	15,473	15,274	8,479	8,044	6,430	2,636	4,468	6,721	4,921	5,974	8,763	9,425	5,778	5,962	4,672	14,856
	0.96%	1.17%	0.74%	1.19%	1.43%	1.61%	3.07%	1.12%	0.71%	1.32%	1.71%	2.59%	2.32%	1.31%	1.38%	1.06%	0.44%	0.94%	1.07%	0.72%	0.83%	1.13%	1.33%	1.22%	1.14%	0.88%	2.22%
Boat-In Camps 151I		6,111	1,422	2,217	7,642	5,888	17,323	4,251	7,473	7,225	11,631	11,844	13,266	6,028	3,340	2,125	396	365	1,126	2,962	2,350	4,513	3,605	2,683	4,347	3,702	1,404
	0.00%	0.88%	0.28%	0.37%	1.04%	0.67%	1.82%	0.55%	1.32%	2.25%	1.63%	1.98%	2.02%	0.93%	0.57%	0.35%	0.07%	0.08%	0.18%	0.43%	0.33%	0.58%	0.51%	0.57%	0.83%	0.69%	0.21%
Craig Saddle 151J						12,697	26,913	10,029	5,140	6,299	12,058	5,528	6,568	7,924	7,734	8,008	2,396	4,408	6,009	5,365	6,850	9,668	11,660	6,488	5,324	3,029	8,343
	0.00%	0.00%	0.00%	0.00%	0.00%	1.45%	2.82%	1.30%	0.91%	1.96%	1.69%	0.93%	1.00%	1.23%	1.32%	1.32%	0.40%	0.92%	0.96%	0.79%	0.96%	1.24%	1.64%	1.37%	1.02%	0.57%	1.25%
Diversion Pool 151K						22,978	33,295	12,367	4,435	6,563	13,115	11,499	11,031	11,414	8,508	8,646	6,924	4,627	5,760	7,079	5,204	9,710	10,351	7,803	6,899	5,733	7,350
	0.00%	0.00%	0.00%	0.00%	0.00%	2.62%	3.49%	1.60%	0.79%	2.04%	1.84%	1.93%	1.68%	1.77%	1.46%	1.42%	1.16%	0.97%	0.92%	1.04%	0.73%	1.25%	1.46%	1.65%	1.32%	1.08%	1.10%

Table B.a-1 (Continued). Official Lake Oroville SRA Attendance (1974/75 – 2000/01)																													
Park Unit		74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	
Parrish Cove 151L							23,849	42,723	10,533	7,732	6,165	6,283	6,790	9,168	7,092	5,761	6,604	2,160	2,769	5,286	3,559	2,817	4,676	7,555	8,600	8,484	7,563	4,539	
		0.00%	0.00%	0.00%	0.00%	0.00%	2.72%	4.48%	1.36%	1.37%	1.92%	0.88%	1.14%	1.39%	1.10%	0.99%	1.09%	0.36%	0.58%	0.84%	0.52%	0.39%	0.60%	1.06%	1.82%	1.63%	1.42%	0.68%	
Loafer Creek Horse Camp 151M																										n/a	n/a	1,058	
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	--	--	0.16%	
Floating Campsites 151N																										n/a	n/a	9,214	
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	--	--	1.38%
Lime Saddle Campground 151O																												35	
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	
Visitor Center 152		149,259	212,041	167,808	254,020	155,992	176,390	122,901	140,649	128,125	64,996	118,762	128,123	131,435	120,879	98,564	109,779	110,005	87,818	110,543	103,174	90,610	73,980	95,330	85,490	94,315	94,238	102,243	
		22.03%	30.66%	32.68%	42.07%	21.28%	20.13%	12.89%	18.18%	22.71%	20.23%	16.64%	21.47%	19.97%	18.71%	16.87%	18.08%	18.42%	18.40%	17.65%	15.13%	12.64%	9.51%	13.42%	18.10%	18.08%	17.69%	15.31%	
Clay Pit OHV 556																					940		5,264	12,917	5,907	4,756	3,147		
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.13%	0.00%	0.74%	2.73%	1.13%	0.89%	0.47%	
Lake Oroville SRA Totals		677,398	691,507	513,480	603,813	733,211	876,204	953,192	773,598	564,100	321,274	713,823	596,781	658,090	646,193	584,277	607,248	597,104	477,166	626,178	681,797	717,106	777,819	710,199	472,301	521,591	532,636	667,899	
FOREBAY OROVILLE (excl. Diversion Pool and Clay Pit)		53,835	45,579	56,863	70,066	95,744	86,703	127,198	133,258	94,577	46,173	101,133	78,958	92,361	86,131	77,316	83,623	126,462	107,886	99,913	96,339	72,466	71,969	68,024	34,738	44,062	57,821	84,775	
		623,563	645,928	456,617	533,747	637,467	766,523	792,699	627,973	465,088	268,538	599,575	506,324	554,698	548,648	498,453	514,979	463,718	364,653	520,505	578,379	638,496	696,140	626,561	416,845	464,724	464,326	572,627	

Source: DPR 2003. Lake Oroville State Recreation Area. Raw data file provided to Recreation and Social Work Group.

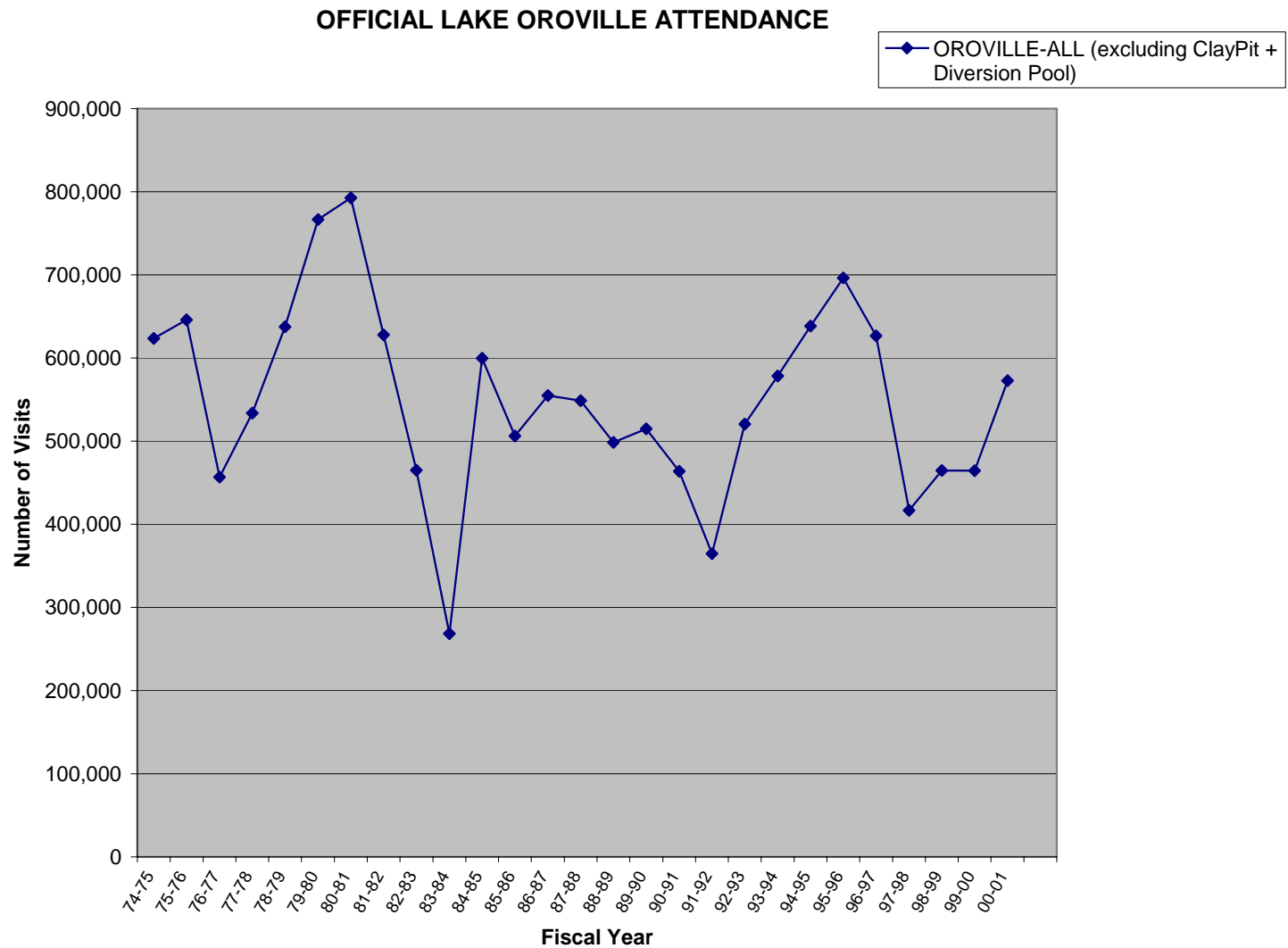


Figure B.a-1. Official Lake Oroville attendance, 1974–2001.

Source: DPR 2003. Lake Oroville State Recreation Area. Raw data file provided to Recreation and Social Work Group.

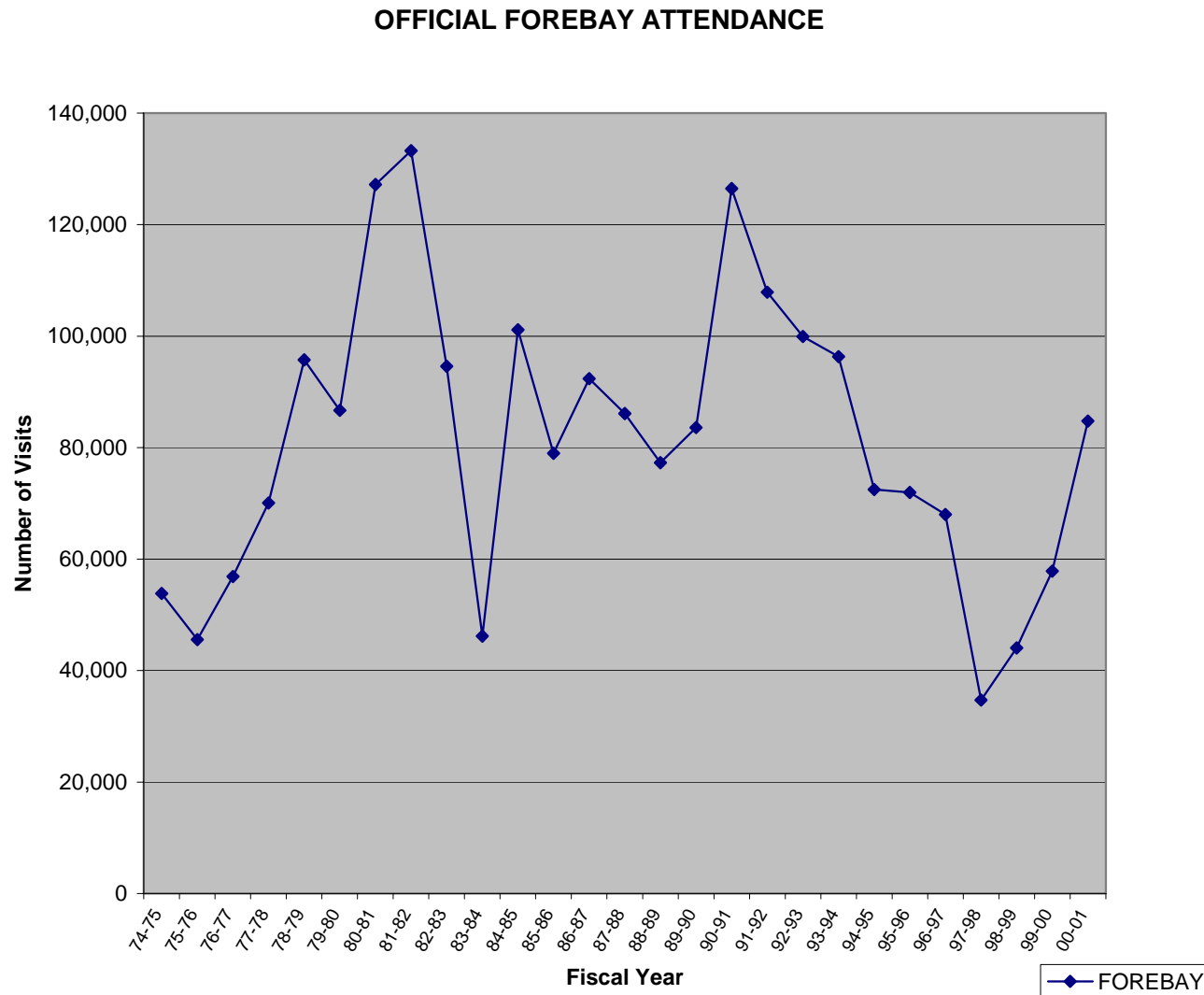


Figure B.a-2. Official Thermalito Forebay attendance, 1974–2001.

Source: DPR 2003. Lake Oroville State Recreation Area. Raw data file provided to Recreation and Social Work Group.

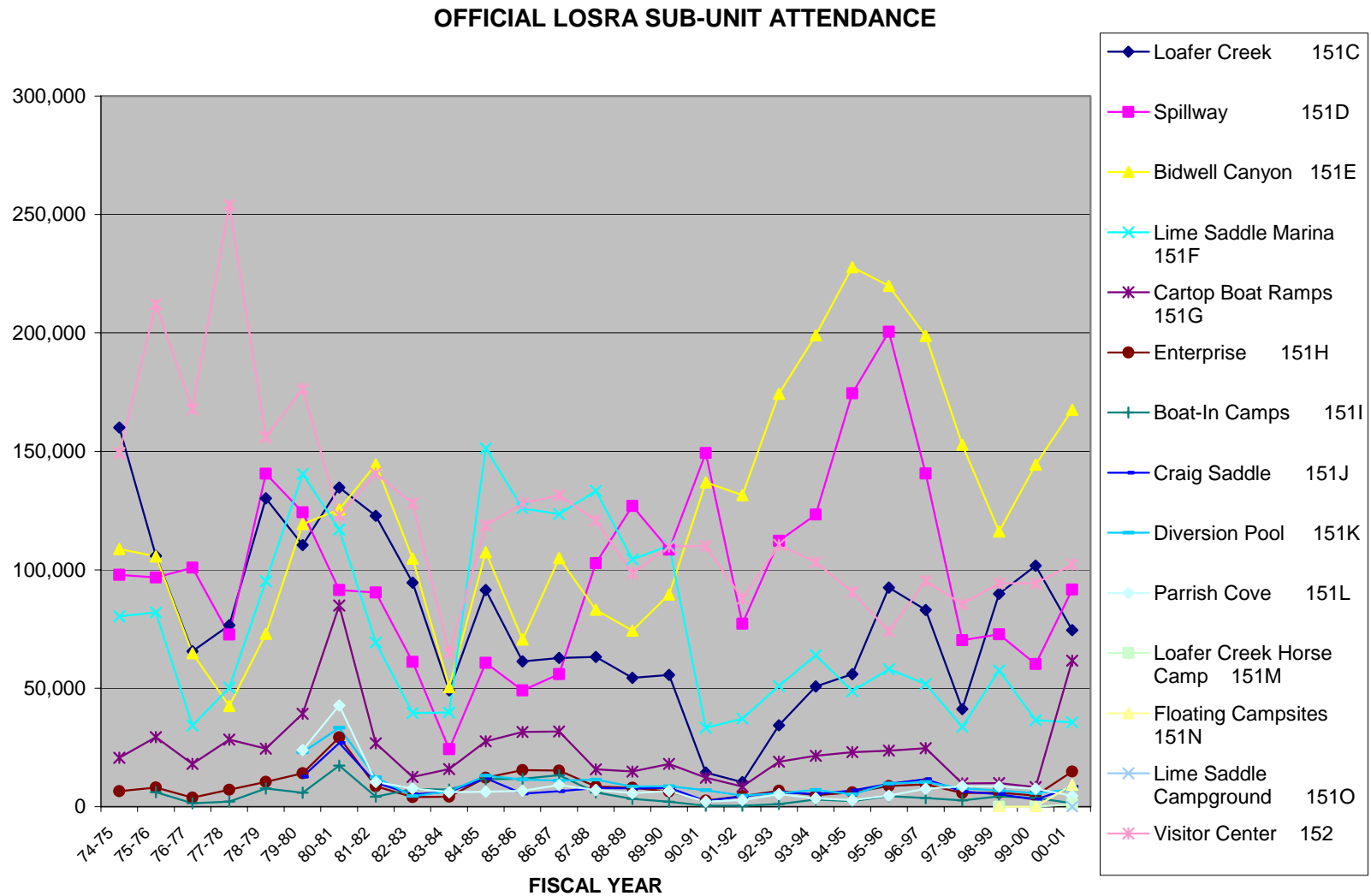


Figure B.a-3. Official attendance at LOSRA by sub-unit, 1974–2001.

Source: DPR 2003. Lake Oroville State Recreation Area. Raw data file provided to Recreation and Social Work Group.

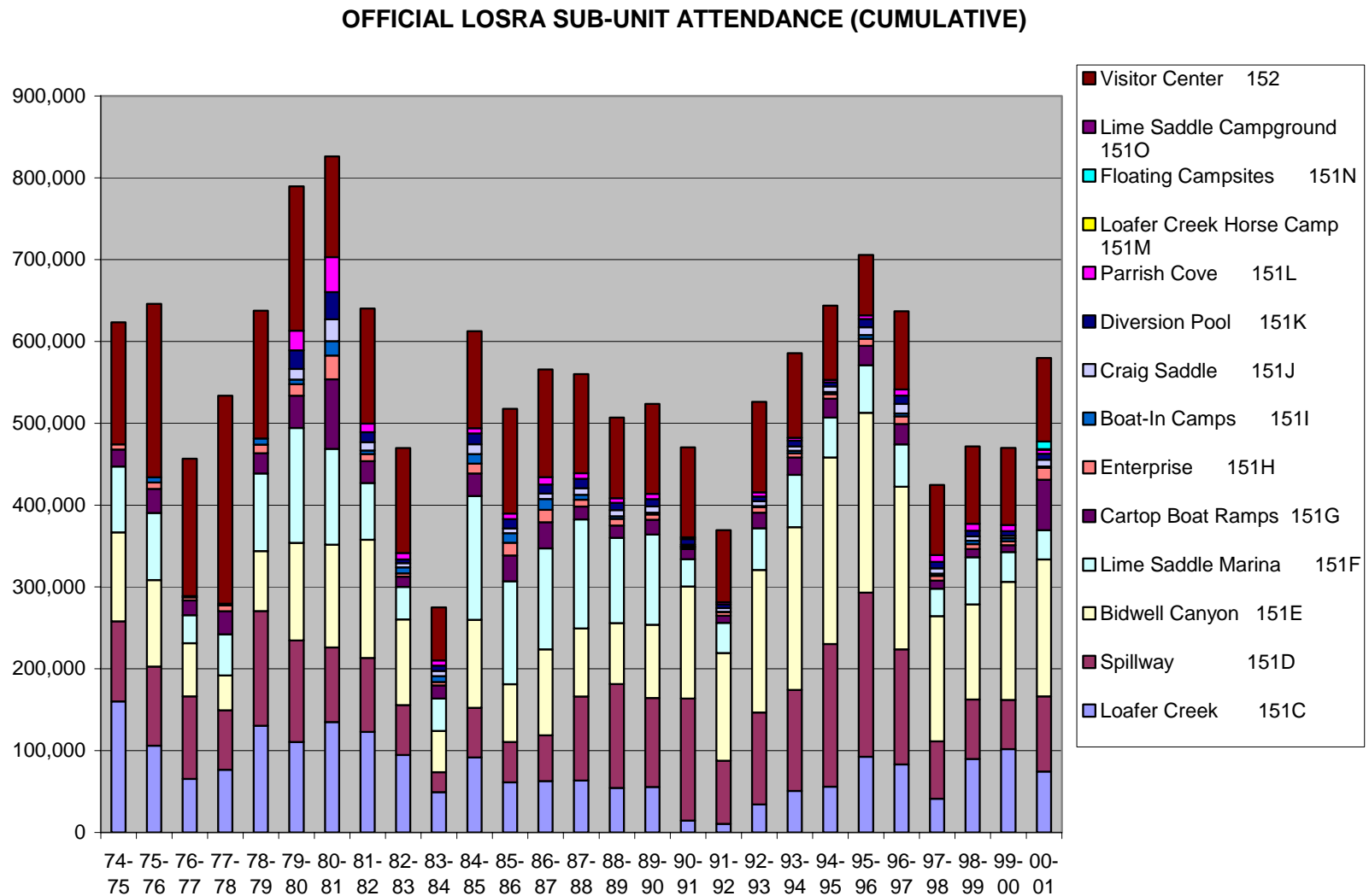


Figure B.a-4. Official attendance at LOSRA, cumulative by sub-unit, 1974–2001.

Source: DPR 2003. Lake Oroville State Recreation Area. Raw data file provided to Recreation and Social Work Group.

APPENDIX B

ATTACHMENT B – VISITOR ORIGIN DATA

Table B.b-1. County of origin, Oroville On-Site Survey respondents. ¹				
County	#	%	Region	Weighting Factor
Butte	1128	48.54%	Oroville Area	61.61%
Sacramento	125	5.38%	Sacramento Area	6.83%
Sutter	121	5.21%	Oroville Area	6.61%
Placer	85	3.66%	Sacramento Area	4.64%
Contra Costa	77	3.31%	SF Bay	4.21%
Yuba	59	2.54%	Oroville Area	3.22%
Solano	57	2.45%	SF Bay	3.11%
Santa Clara	56	2.41%	SF Bay	3.06%
Alameda	42	1.81%	SF Bay	2.29%
San Joaquin	27	1.16%	Central/Central Coast CA	1.47%
Yolo	27	1.16%	Sacramento Area	1.47%
Sonoma	27	1.16%	SF Bay	1.47%
<hr/>				
Nevada	21	0.90%	North	100.0%
San Mateo	17	0.73%	SF Bay	
San Francisco	16	0.69%	SF Bay	
El Dorado	14	0.60%	Sacramento Area	
Tehama	12	0.52%	North	
Los Angeles	12	0.52%	Southern CA	
Stanislaus	11	0.47%	Central/Central Coast CA	
Glenn	11	0.47%	North	
Plumas	10	0.43%	North	
Shasta	10	0.43%	North	
Napa	9	0.39%	SF Bay	
Lassen	8	0.34%	North	
San Diego	8	0.34%	Southern CA	
Marin	7	0.30%	SF Bay	
Santa Cruz	6	0.26%	Central/Central Coast CA	
Lake	6	0.26%	North	
Fresno	5	0.22%	Central/Central Coast CA	
Monterey	5	0.22%	Central/Central Coast CA	
Orange	5	0.22%	Southern CA	
Kings	4	0.17%	Central/Central Coast CA	
Tulare	4	0.17%	Central/Central Coast CA	
Colusa	4	0.17%	Oroville Area	
San Bernardino	4	0.17%	Southern CA	
Ventura	4	0.17%	Southern CA	
Mariposa	3	0.13%	Central/Central Coast CA	
Amador	3	0.13%	Sacramento Area	
Kern	3	0.13%	Southern CA	
Riverside	3	0.13%	Southern CA	
Calaveras	2	0.09%	Central/Central Coast CA	
Merced	2	0.09%	Central/Central Coast CA	
Del Norte	2	0.09%	North	
Humboldt	2	0.09%	North	

Inyo	1	0.04%	Central/Central Coast CA	
Madera	1	0.04%	Central/Central Coast CA	
Table B.b-1 (Continued). County of origin, Oroville On-Site Survey respondents.¹				
County	#	%	Region	Weighting Factor
San Benito	1	0.04%	Central/Central Coast CA	
Mendocino	1	0.04%	North	
Sierra	1	0.04%	North	
Siskyou	1	0.04%	North	
Trinity	1	0.04%	North	
Imperial	1	0.04%	Southern CA	
San Luis Obispo	1	0.04%	Southern CA	
Santa Barbara	1	0.04%	Southern CA	
TOTAL	2074	89.24%		
US outside CA	5			
Outside US	72			
Not valid	170			
Total of all respondents	2321			

Source: EDAW 2004.

¹Based on interim results of On-Site Survey administered as part of the relicensing process, and may differ from the final results presented in this report.

APPENDIX B

ATTACHMENT C – DESCRIPTIVE STATISTICS

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Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
YEAR	26	1	27	14.15	8.053
DV_7980	26	0	1	.77	.430
DV_8081	26	0	1	.73	.452
ORO_ATT	26	364653	792699	560740.62	103339.176
ORO_ATT_PC	26	1.0692	2.9890	1.881564	.5524917
FRBAY_ATT	26	34738	133258	82607.65	25513.827
FRBAY_ATT_PC	26	.0948	.4914	.274537	.0960798
ORO_EL	26	699.90	868.18	818.1138	46.47822
ORO_EL_J	26	678.24	894.77	837.8442	58.95671
ORO_EL5	26	724.32	890.86	831.2268	46.76491
ORO_EL3	26	662.93	889.21	817.4215	58.92337
ORO_EL_2	26	708.85	895.72	851.9369	53.89908
ORO_EL_D	26	7.87	58.00	37.6304	11.63019
ALM_RAT	26	.61	1.39	1.0887	.17468
SHA_RAT	26	.76	1.52	1.0478	.13182
FOL_RAT	26	.83	1.52	1.1775	.17621
POP_CA	26	21174000	34036000	2.8E+07	4177723.538
POP_NCL	26	7161700	11085595	9142315	1269624.917
POP_BUT	26	118100	203171	167879.65	28336.275
POP_WGHT	26	228155	381691	309176.04	49861.259
PCI_CA_A	26	22696.47	32149.00	26988.00	2334.45513
PCI_BT_A	26	17835.64	22325.00	19927.60	1228.67865
UE_CA_U	26	4.90	10.48	7.2394	1.57856
UE_BUT_U	26	6.78	14.56	10.1120	2.02063
GAS_CA	26	1.24	2.45	1.5870	.33344
TEMP_MAX	26	72.08	77.25	74.8650	1.39101
PREC_ALL	26	7.94	56.69	30.0343	11.87899
TMP_AVE	26	58.40	63.41	61.6601	1.11089
AGE_55	26	21.6220	23.8425	23.278446	.5677689
ETH_WHT	26	76.5014	87.8714	82.066601	3.7066972
ETH_HSP	26	6.1684	11.9907	9.237867	1.8220645
BOAT_REG	26	10525	19049	14537.88	2809.794
FSH_LIC	26	27995	50067	38185.23	8025.304
FISH_STK	25	57400	514133	241649.48	122192.676
FSTK_LAG	25	57400	514133	242151.92	121946.095
IV_LGYR	26	.00	3.30	2.0665	1.31493
IVF_GAS	26	.00	2.45	1.1996	.74413
IVF_LGYR	26	.00	3.30	2.1414	1.24618
Valid N (listwise)	24				

Source: EDAW 2003.

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APPENDIX B

ATTACHMENT D – CORRELATION MATRIX

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Correlations

		Correlations														
		YEAR	L_YEAR	DV_7980	DV_8081	ORO_EL	L_ORO_EL	ORO_EL_J	L_OREL_J	ORO_EL5	L_OR_EL5	ORO_EL3	L_OR_EL3	ORO_EL_2	L_OR_EL2	ORO_EL_D
YEAR	Pearson Correlation	1	.926**	.739**	.780**	-.038	-.035	.002	.011	-.016	-.012	-.016	-.007	-.009	-.001	.119
	Sig. (2-tailed)	.	.000	.000	.000	.855	.864	.991	.957	.938	.952	.938	.972	.967	.995	.562
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
L_YEAR	Pearson Correlation	.926**	1	.845**	.849**	-.033	-.033	-.074	-.062	-.063	-.059	-.081	-.071	-.004	.003	-.006
	Sig. (2-tailed)	.000	.	.000	.000	.873	.874	.720	.762	.759	.775	.695	.732	.983	.990	.979
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
DV_7980	Pearson Correlation	.739**	.845**	1	.902**	.041	.041	.018	.032	.020	.025	.006	.020	.033	.042	.063
	Sig. (2-tailed)	.000	.000	.	.000	.844	.841	.931	.875	.923	.902	.976	.923	.871	.838	.758
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
DV_8081	Pearson Correlation	.780**	.849**	.902**	1	-.037	-.034	-.023	-.010	-.039	-.034	-.041	-.029	-.017	-.008	.131
	Sig. (2-tailed)	.000	.000	.000	.	.858	.867	.912	.963	.850	.870	.841	.890	.936	.968	.522
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ORO_EL	Pearson Correlation	-.038	-.033	.041	-.037	1	1.000**	.862**	.856**	.978**	.980**	.884**	.878**	.673**	.677**	-.177
	Sig. (2-tailed)	.855	.873	.844	.858	.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.387
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
L_ORO_EL	Pearson Correlation	-.035	-.033	.041	-.034	1.000**	1	.860**	.854**	.977**	.979**	.881**	.876**	.676**	.680**	-.166
	Sig. (2-tailed)	.864	.874	.841	.867	.000	.	.000	.000	.000	.000	.000	.000	.000	.000	.418
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ORO_EL_J	Pearson Correlation	.002	-.074	.018	-.023	.862**	.860**	1	.999**	.883**	.883**	.995**	.996**	.285	.290	.074
	Sig. (2-tailed)	.991	.720	.931	.912	.000	.000	.	.000	.000	.000	.000	.000	.158	.150	.718
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
L_OREL_J	Pearson Correlation	.011	-.062	.032	-.010	.856**	.854**	.999**	1	.877**	.877**	.992**	.995**	.274	.279	.086
	Sig. (2-tailed)	.957	.762	.875	.963	.000	.000	.000	.	.000	.000	.000	.000	.175	.167	.675
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ORO_EL5	Pearson Correlation	-.016	-.063	.020	-.039	.978**	.977**	.883**	.877**	1	1.000**	.899**	.893**	.695**	.698**	-.106
	Sig. (2-tailed)	.938	.759	.923	.850	.000	.000	.000	.000	.	.000	.000	.000	.000	.000	.605
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
L_OR_EL5	Pearson Correlation	-.012	-.059	.025	-.034	.980**	.979**	.883**	.877**	1.000**	1	.897**	.892**	.697**	.701**	-.095
	Sig. (2-tailed)	.952	.775	.902	.870	.000	.000	.000	.000	.000	.	.000	.000	.000	.000	.643
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ORO_EL3	Pearson Correlation	-.016	-.081	.006	-.041	.884**	.881**	.995**	.992**	.899**	.897**	1	.999**	.310	.314	-.029
	Sig. (2-tailed)	.938	.695	.976	.841	.000	.000	.000	.000	.000	.000	.	.000	.124	.118	.888
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
L_OR_EL3	Pearson Correlation	-.007	-.071	.020	-.029	.878**	.876**	.996**	.995**	.893**	.892**	.999**	1	.298	.303	-.013
	Sig. (2-tailed)	.972	.732	.923	.890	.000	.000	.000	.000	.000	.000	.000	.	.139	.133	.949
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ORO_EL_2	Pearson Correlation	-.009	-.004	.033	-.017	.673**	.676**	.285	.274	.695**	.697**	.310	.298	1	1.000**	-.183
	Sig. (2-tailed)	.967	.983	.871	.936	.000	.000	.158	.175	.000	.000	.124	.139	.	.000	.371
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
L_OR_EL2	Pearson Correlation	-.001	.003	.042	-.008	.677**	.680**	.290	.279	.698**	.701**	.314	.303	1.000**	1	-.179
	Sig. (2-tailed)	.995	.990	.838	.968	.000	.000	.150	.167	.000	.000	.118	.133	.000	.	.383
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ORO_EL_D	Pearson Correlation	.119	-.006	.063	.131	-.177	-.166	.074	.086	-.106	-.095	-.029	-.013	-.183	-.179	1
	Sig. (2-tailed)	.562	.979	.758	.522	.387	.418	.718	.675	.605	.643	.888	.949	.371	.383	.
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
L_OR_ELD	Pearson Correlation	-.005	-.074	-.007	.038	-.108	-.098	.058	.070	-.078	-.065	-.039	-.023	-.105	-.102	.949**
	Sig. (2-tailed)	.980	.720	.973	.855	.598	.635	.778	.735	.706	.751	.850	.910	.611	.621	.000
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26

Correlations

		YEAR	L_YEAR	DV_7980	DV_8081	ORO_EL	L_ORO_EL	ORO_EL_J	L_OREL_J	ORO_EL5	L_OR_EL5	ORO_EL3	L_OR_EL3	ORO_EL_2	L_OR_EL2	ORO_EL_D
ALM_RAT	Pearson Correlation	-.343	-.295	-.322	-.361	.851**	.853**	.649**	.641**	.785**	.789**	.678**	.670**	.592**	.594**	-.250
	Sig. (2-tailed)	.087	.143	.109	.070	.000	.000	.000	.000	.000	.000	.000	.000	.001	.001	.218
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
SHA_RAT	Pearson Correlation	-.354	-.222	-.220	-.204	-.094	-.093	-.091	-.083	-.186	-.184	-.055	-.048	-.314	-.327	-.375
	Sig. (2-tailed)	.076	.275	.281	.317	.646	.652	.659	.687	.362	.367	.790	.815	.118	.103	.059
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
FOL_RAT	Pearson Correlation	.230	.279	.204	.228	.216	.221	.125	.129	.155	.161	.134	.135	.116	.115	-.114
	Sig. (2-tailed)	.258	.167	.318	.262	.288	.277	.543	.531	.450	.432	.514	.511	.571	.575	.579
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
POP_CA	Pearson Correlation	.996**	.924**	.742**	.788**	-.092	-.089	-.042	-.032	-.067	-.064	-.061	-.051	-.046	-.039	.122
	Sig. (2-tailed)	.000	.000	.000	.000	.656	.665	.839	.875	.745	.758	.769	.803	.822	.850	.551
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
L_POP_CA	Pearson Correlation	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POP_NCL	Pearson Correlation	.998**	.921**	.735**	.779**	-.071	-.068	-.025	-.016	-.046	-.042	-.043	-.034	-.028	-.021	.121
	Sig. (2-tailed)	.000	.000	.000	.000	.732	.740	.905	.939	.825	.838	.835	.868	.891	.918	.555
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
L_POP_NC	Pearson Correlation	.996**	.938**	.762**	.803**	-.074	-.071	-.035	-.025	-.053	-.049	-.053	-.043	-.029	-.022	.110
	Sig. (2-tailed)	.000	.000	.000	.000	.721	.729	.865	.902	.797	.810	.799	.834	.888	.917	.591
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
POP_BUT	Pearson Correlation	.989**	.951**	.789**	.822**	-.068	-.066	-.046	-.037	-.051	-.048	-.060	-.051	-.012	-.005	.075
	Sig. (2-tailed)	.000	.000	.000	.000	.741	.747	.823	.859	.804	.816	.770	.804	.953	.980	.714
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
L_POP_BT	Pearson Correlation	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCI_CA_A	Pearson Correlation	.895**	.879**	.686**	.722**	-.162	-.159	-.082	-.069	-.150	-.145	-.114	-.101	-.138	-.129	.250
	Sig. (2-tailed)	.000	.000	.000	.000	.429	.439	.690	.737	.464	.481	.578	.622	.501	.530	.218
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
PCI_BT_A	Pearson Correlation	.890**	.817**	.574**	.598**	-.163	-.158	-.089	-.077	-.135	-.129	-.122	-.110	-.093	-.085	.254
	Sig. (2-tailed)	.000	.000	.002	.001	.427	.439	.666	.707	.511	.529	.554	.594	.651	.679	.210
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
UE_CA_U	Pearson Correlation	-.439*	-.444*	-.250	-.229	-.013	-.018	-.055	-.066	-.002	-.008	-.024	-.034	.034	.027	-.250
	Sig. (2-tailed)	.025	.023	.218	.260	.948	.931	.788	.750	.991	.967	.908	.868	.868	.895	.218
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
UE_BUT_U	Pearson Correlation	-.632**	-.577**	-.402*	-.380	.128	.125	.021	.008	.097	.093	.058	.044	.116	.109	-.292
	Sig. (2-tailed)	.001	.002	.042	.056	.532	.541	.919	.971	.638	.652	.780	.831	.574	.597	.147
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
GAS_CA	Pearson Correlation	-.512**	-.407*	-.154	-.373	.303	.298	.219	.216	.264	.261	.226	.224	.202	.198	-.048
	Sig. (2-tailed)	.007	.039	.453	.061	.132	.140	.283	.290	.192	.197	.266	.271	.323	.333	.815
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
L_GAS_CA	Pearson Correlation	-.536**	-.444*	-.212	-.409*	.287	.282	.215	.210	.252	.249	.222	.218	.184	.180	-.042
	Sig. (2-tailed)	.005	.023	.299	.038	.155	.163	.292	.302	.214	.219	.277	.284	.369	.379	.837
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
TEMP_MAX	Pearson Correlation	.381	.340	.279	.253	-.068	-.066	.013	.015	-.067	-.065	.024	.026	-.185	-.174	-.151
	Sig. (2-tailed)	.055	.089	.167	.212	.740	.750	.949	.944	.744	.753	.908	.901	.366	.394	.463
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26

Correlations

		YEAR	L_YEAR	DV_7980	DV_8081	ORO_EL	L_ORO_EL	ORO_EL_J	L_OREL_J	ORO_EL5	L_OR_EL5	ORO_EL3	L_OR_EL3	ORO_EL_2	L_OR_EL2	ORO_EL_D
TEMP_5	Pearson Correlation	.265	.151	.238	.251	.088	.092	.129	.126	.146	.148	.116	.116	.125	.139	.143
	Sig. (2-tailed)	.191	.463	.241	.215	.668	.655	.529	.539	.478	.470	.572	.572	.542	.498	.485
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
TEMP_3	Pearson Correlation	.249	.120	.129	.175	.022	.022	-.019	-.021	.093	.094	-.039	-.039	.266	.271	.187
	Sig. (2-tailed)	.220	.561	.531	.392	.916	.914	.925	.920	.650	.649	.851	.851	.189	.181	.361
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
TEMP_2LG	Pearson Correlation	-.038	-.062	.004	.141	-.110	-.096	.000	.019	-.117	-.101	-.055	-.034	-.162	-.156	.496*
	Sig. (2-tailed)	.854	.763	.985	.491	.593	.641	.999	.925	.571	.623	.788	.871	.429	.448	.010
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
PREC_ALL	Pearson Correlation	.166	.234	.303	.323	.227	.229	-.047	-.047	.237	.238	-.043	-.044	.585**	.581**	-.018
	Sig. (2-tailed)	.419	.250	.133	.107	.264	.261	.820	.820	.244	.241	.833	.832	.002	.002	.931
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
PREC_5	Pearson Correlation	.096	.133	.172	.202	.164	.166	.111	.119	.164	.166	.124	.130	.153	.144	-.168
	Sig. (2-tailed)	.640	.518	.402	.323	.425	.417	.588	.563	.423	.417	.546	.526	.456	.483	.413
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
PREC_3	Pearson Correlation	.138	.141	.118	.156	.101	.102	-.134	-.139	.099	.097	-.108	-.115	.391*	.385	-.269
	Sig. (2-tailed)	.502	.492	.565	.446	.622	.621	.515	.498	.630	.637	.601	.577	.048	.052	.183
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
PREC_LG	Pearson Correlation	.321	.337	.363	.318	.654**	.647**	.691**	.682**	.703**	.696**	.713**	.704**	.349	.354	-.225
	Sig. (2-tailed)	.118	.099	.074	.122	.000	.000	.000	.000	.000	.000	.000	.000	.088	.082	.280
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
temp_ave_3lg	Pearson Correlation	-.044	-.054	-.037	.047	-.241	-.225	-.198	-.184	-.267	-.250	-.272	-.254	-.134	-.127	.695**
	Sig. (2-tailed)	.832	.792	.858	.818	.236	.270	.331	.369	.187	.218	.179	.211	.513	.536	.000
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
PREC_AVE	Pearson Correlation	.166	.234	.303	.323	.227	.229	-.047	-.047	.237	.238	-.043	-.044	.585**	.581**	-.018
	Sig. (2-tailed)	.419	.250	.133	.107	.264	.261	.820	.820	.244	.241	.833	.832	.002	.002	.931
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
prec_ave_3lg	Pearson Correlation	.257	.204	.058	.105	.441*	.433*	.424*	.411*	.478*	.469*	.452*	.438*	.296	.292	-.228
	Sig. (2-tailed)	.204	.317	.779	.611	.024	.027	.031	.037	.014	.016	.021	.025	.142	.147	.263
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
AGE_55	Pearson Correlation	.736**	.912**	.857**	.765**	.045	.042	-.047	-.035	-.004	-.001	-.050	-.039	.072	.079	-.037
	Sig. (2-tailed)	.000	.000	.000	.000	.828	.839	.819	.864	.983	.996	.809	.849	.726	.702	.856
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ETH_WHT	Pearson Correlation	-.997**	-.926**	-.752**	-.805**	.071	.068	.022	.012	.047	.044	.041	.031	.036	.028	-.129
	Sig. (2-tailed)	.000	.000	.000	.000	.731	.742	.917	.954	.818	.833	.843	.879	.861	.890	.531
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
ETH_HSP	Pearson Correlation	.930**	.904**	.772**	.820**	-.047	-.043	-.033	-.021	-.031	-.026	-.049	-.037	.013	.020	.097
	Sig. (2-tailed)	.000	.000	.000	.000	.820	.834	.873	.920	.881	.900	.813	.858	.950	.924	.638
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
BOAT_REG	Pearson Correlation	.985**	.883**	.663**	.716**	-.110	-.108	-.047	-.038	-.080	-.077	-.064	-.056	-.069	-.062	.108
	Sig. (2-tailed)	.000	.000	.000	.000	.592	.601	.821	.853	.697	.708	.755	.787	.739	.763	.599
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
FSH_LIC	Pearson Correlation	-.927**	-.806**	-.572**	-.665**	.237	.233	.177	.170	.207	.203	.192	.185	.134	.128	-.087
	Sig. (2-tailed)	.000	.000	.002	.000	.244	.253	.387	.406	.311	.319	.348	.365	.514	.534	.673
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
FISH_STK	Pearson Correlation	.219	.067	-.123	-.159	.202	.202	.146	.138	.157	.156	.173	.165	.055	.053	-.267
	Sig. (2-tailed)	.293	.751	.559	.447	.332	.332	.485	.509	.454	.457	.408	.429	.793	.801	.198
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

Correlations

		YEAR	L_YEAR	DV_7980	DV_8081	ORO_EL	L_ORO_EL	ORO_EL_J	L_OREL_J	ORO_EL5	L_OR_EL5	ORO_EL3	L_OR_EL3	ORO_EL_2	L_OR_EL2	ORO_EL_D
FSTK_LAG	Pearson Correlation	.215	.070	-.180	-.121	.070	.077	.018	.015	.086	.089	.003	.002	.181	.168	.159
	Sig. (2-tailed)	.301	.739	.390	.566	.739	.716	.931	.942	.681	.673	.987	.993	.387	.421	.448
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
IV_ELEV	Pearson Correlation	.772**	.839**	.897**	.994**	.052	.054	.050	.061	.046	.051	.033	.045	.044	.053	.111
	Sig. (2-tailed)	.000	.000	.000	.000	.802	.792	.810	.765	.824	.804	.871	.826	.830	.799	.590
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
IV_GAS	Pearson Correlation	.607**	.705**	.840**	.931**	.053	.054	.048	.059	.042	.047	.028	.040	.046	.053	.149
	Sig. (2-tailed)	.001	.000	.000	.000	.798	.795	.817	.774	.837	.821	.893	.847	.822	.797	.467
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
IV_LGYR	Pearson Correlation	.899**	.908**	.878**	.973**	-.064	-.062	-.029	-.016	-.053	-.048	-.049	-.037	-.035	-.027	.142
	Sig. (2-tailed)	.000	.000	.000	.000	.755	.765	.890	.937	.796	.815	.812	.858	.865	.897	.488
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
IVF_ELEV	Pearson Correlation	.724**	.830**	.994**	.887**	.137	.138	.096	.109	.112	.117	.087	.100	.100	.108	.038
	Sig. (2-tailed)	.000	.000	.000	.000	.505	.502	.642	.597	.587	.569	.673	.629	.628	.600	.853
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
IVF_GAS	Pearson Correlation	.483*	.628**	.900**	.708**	.164	.162	.106	.118	.128	.132	.098	.110	.118	.124	.042
	Sig. (2-tailed)	.012	.001	.000	.000	.424	.428	.606	.565	.533	.521	.635	.594	.567	.546	.839
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
IVF_LGYR	Pearson Correlation	.893**	.926**	.960**	.926**	-.015	-.013	-.002	.011	-.015	-.010	-.018	-.005	-.003	.006	.100
	Sig. (2-tailed)	.000	.000	.000	.000	.943	.950	.992	.956	.942	.961	.929	.980	.989	.977	.628
	N	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26

Correlations

		L_OR_ELD	ALM_RAT	SHA_RAT	FOL_RAT	POP_CA	L_POP_CA	POP_NCL	L_POP_NC	POP_BUT	L_POP_BT	PCI_CA_A	PCI_BT_A	UE_CA_U	UE_BUT_U	GAS_CA
YEAR	Pearson Correlation	-.005	-.343	-.354	.230	.996**	.a	.998**	.996**	.989**	.a	.895**	.890**	-.439*	-.632**	-.512**
	Sig. (2-tailed)	.980	.087	.076	.258	.000	.	.000	.000	.000	.	.000	.000	.025	.001	.007
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
L_YEAR	Pearson Correlation	-.074	-.295	-.222	.279	.924**	.a	.921**	.938**	.951**	.a	.879**	.817**	-.444*	-.577**	-.407*
	Sig. (2-tailed)	.720	.143	.275	.167	.000	.	.000	.000	.000	.	.000	.000	.023	.002	.039
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
DV_7980	Pearson Correlation	-.007	-.322	-.220	.204	.742**	.a	.735**	.762**	.789**	.a	.686**	.574**	-.250	-.402*	-.154
	Sig. (2-tailed)	.973	.109	.281	.318	.000	.	.000	.000	.000	.	.000	.002	.218	.042	.453
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
DV_8081	Pearson Correlation	.038	-.361	-.204	.228	.788**	.a	.779**	.803**	.822**	.a	.722**	.598**	-.229	-.380	-.373
	Sig. (2-tailed)	.855	.070	.317	.262	.000	.	.000	.000	.000	.	.000	.001	.260	.056	.061
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
ORO_EL	Pearson Correlation	-.108	.851**	-.094	.216	-.092	.a	-.071	-.074	-.068	.a	-.162	-.163	-.013	.128	.303
	Sig. (2-tailed)	.598	.000	.646	.288	.656	.	.732	.721	.741	.	.429	.427	.948	.532	.132
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
L_ORO_EL	Pearson Correlation	-.098	.853**	-.093	.221	-.089	.a	-.068	-.071	-.066	.a	-.159	-.158	-.018	.125	.298
	Sig. (2-tailed)	.635	.000	.652	.277	.665	.	.740	.729	.747	.	.439	.439	.931	.541	.140
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
ORO_EL_J	Pearson Correlation	.058	.649**	-.091	.125	-.042	.a	-.025	-.035	-.046	.a	-.082	-.089	-.055	.021	.219
	Sig. (2-tailed)	.778	.000	.659	.543	.839	.	.905	.865	.823	.	.690	.666	.788	.919	.283
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
L_OREL_J	Pearson Correlation	.070	.641**	-.083	.129	-.032	.a	-.016	-.025	-.037	.a	-.069	-.077	-.066	.008	.216
	Sig. (2-tailed)	.735	.000	.687	.531	.875	.	.939	.902	.859	.	.737	.707	.750	.971	.290
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
ORO_EL5	Pearson Correlation	-.078	.785**	-.186	.155	-.067	.a	-.046	-.053	-.051	.a	-.150	-.135	-.002	.097	.264
	Sig. (2-tailed)	.706	.000	.362	.450	.745	.	.825	.797	.804	.	.464	.511	.991	.638	.192
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
L_OR_EL5	Pearson Correlation	-.065	.789**	-.184	.161	-.064	.a	-.042	-.049	-.048	.a	-.145	-.129	-.008	.093	.261
	Sig. (2-tailed)	.751	.000	.367	.432	.758	.	.838	.810	.816	.	.481	.529	.967	.652	.197
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
ORO_EL3	Pearson Correlation	-.039	.678**	-.055	.134	-.061	.a	-.043	-.053	-.060	.a	-.114	-.122	-.024	.058	.226
	Sig. (2-tailed)	.850	.000	.790	.514	.769	.	.835	.799	.770	.	.578	.554	.908	.780	.266
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
L_OR_EL3	Pearson Correlation	-.023	.670**	-.048	.135	-.051	.a	-.034	-.043	-.051	.a	-.101	-.110	-.034	.044	.224
	Sig. (2-tailed)	.910	.000	.815	.511	.803	.	.868	.834	.804	.	.622	.594	.868	.831	.271
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
ORO_EL_2	Pearson Correlation	-.105	.592**	-.314	.116	-.046	.a	-.028	-.029	-.012	.a	-.138	-.093	.034	.116	.202
	Sig. (2-tailed)	.611	.001	.118	.571	.822	.	.891	.888	.953	.	.501	.651	.868	.574	.323
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
L_OR_EL2	Pearson Correlation	-.102	.594**	-.327	.115	-.039	.a	-.021	-.022	-.005	.a	-.129	-.085	.027	.109	.198
	Sig. (2-tailed)	.621	.001	.103	.575	.850	.	.918	.917	.980	.	.530	.679	.895	.597	.333
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
ORO_EL_D	Pearson Correlation	.949**	-.250	-.375	-.114	.122	.a	.121	.110	.075	.a	.250	.254	-.250	-.292	-.048
	Sig. (2-tailed)	.000	.218	.059	.579	.551	.	.555	.591	.714	.	.218	.210	.218	.147	.815
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
L_OR_ELD	Pearson Correlation	1	-.088	-.257	-.094	-.009	.a	-.008	-.015	-.047	.a	.136	.133	-.210	-.173	.031
	Sig. (2-tailed)	.	.668	.205	.648	.964	.	.968	.940	.820	.	.507	.518	.304	.398	.879
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26

Correlations

		L_OR_ELD	ALM_RAT	SHA_RAT	FOL_RAT	POP_CA	L_POP_CA	POP_NCL	L_POP_NC	POP_BUT	L_POP_BT	PCI_CA_A	PCI_BT_A	UE_CA_U	UE_BUT_U	GAS_CA
ALM_RAT	Pearson Correlation	-.088	1	.152	.199	-.391*	.a	-.372	-.377	-.375	.a	-.414*	-.399*	.088	.354	.341
	Sig. (2-tailed)	.668	.	.459	.330	.048	.	.061	.058	.059	.	.036	.044	.670	.076	.088
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
SHA_RAT	Pearson Correlation	-.257	.152	1	.307	-.352	.a	-.358	-.346	-.332	.a	-.363	-.398*	.164	.325	-.011
	Sig. (2-tailed)	.205	.459	.	.128	.078	.	.073	.084	.098	.	.069	.044	.423	.105	.956
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
FOL_RAT	Pearson Correlation	-.094	.199	.307	1	.239	.a	.233	.245	.266	.a	.047	.078	.042	.041	-.362
	Sig. (2-tailed)	.648	.330	.128	.	.240	.	.252	.228	.188	.	.820	.705	.839	.844	.069
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
POP_CA	Pearson Correlation	-.009	-.391*	-.352	.239	1	.a	.999**	.999**	.994**	.a	.890**	.890**	-.408*	-.622**	-.545**
	Sig. (2-tailed)	.964	.048	.078	.240	.	.	.000	.000	.000	.	.000	.000	.039	.001	.004
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
L_POP_CA	Pearson Correlation	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POP_NCL	Pearson Correlation	-.008	-.372	-.358	.233	.999**	.a	1	.998**	.993**	.a	.887**	.889**	-.410*	-.621**	-.531**
	Sig. (2-tailed)	.968	.061	.073	.252	.000	.	.	.000	.000	.	.000	.000	.037	.001	.005
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
L_POP_NC	Pearson Correlation	-.015	-.377	-.346	.245	.999**	.a	.998**	1	.997**	.a	.892**	.886**	-.412*	-.620**	-.530**
	Sig. (2-tailed)	.940	.058	.084	.228	.000	.	.000	.	.000	.	.000	.000	.037	.001	.005
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
POP_BUT	Pearson Correlation	-.047	-.375	-.332	.266	.994**	.a	.993**	.997**	1	.a	.875**	.865**	-.383	-.597**	-.511**
	Sig. (2-tailed)	.820	.059	.098	.188	.000	.	.000	.000	.	.	.000	.000	.054	.001	.008
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
L_POP_BT	Pearson Correlation	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCI_CA_A	Pearson Correlation	.136	-.414*	-.363	.047	.890**	.a	.887**	.892**	.875**	.a	1	.962**	-.705**	-.819**	-.509**
	Sig. (2-tailed)	.507	.036	.069	.820	.000	.	.000	.000	.000	.	.	.000	.000	.000	.008
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
PCI_BT_A	Pearson Correlation	.133	-.399*	-.398*	.078	.890**	.a	.889**	.886**	.865**	.a	.962**	1	-.714**	-.872**	-.570**
	Sig. (2-tailed)	.518	.044	.044	.705	.000	.	.000	.000	.000	.	.000	.	.000	.000	.002
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
UE_CA_U	Pearson Correlation	-.210	.088	.164	.042	-.408*	.a	-.410*	-.412*	-.383	.a	-.705**	-.714**	1	.899**	.350
	Sig. (2-tailed)	.304	.670	.423	.839	.039	.	.037	.037	.054	.	.000	.000	.	.000	.080
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
UE_BUT_U	Pearson Correlation	-.173	.354	.325	.041	-.622**	.a	-.621**	-.620**	-.597**	.a	-.819**	-.872**	.899**	1	.430*
	Sig. (2-tailed)	.398	.076	.105	.844	.001	.	.001	.001	.001	.	.000	.000	.000	.	.028
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
GAS_CA	Pearson Correlation	.031	.341	-.011	-.362	-.545**	.a	-.531**	-.530**	-.511**	.a	-.509**	-.570**	.350	.430*	1
	Sig. (2-tailed)	.879	.088	.956	.069	.004	.	.005	.005	.008	.	.008	.002	.080	.028	.
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
L_GAS_CA	Pearson Correlation	.035	.351	-.013	-.392*	-.569**	.a	-.554**	-.556**	-.540**	.a	-.535**	-.598**	.371	.460*	.995**
	Sig. (2-tailed)	.865	.079	.949	.048	.002	.	.003	.003	.004	.	.005	.001	.062	.018	.000
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
TEMP_MAX	Pearson Correlation	-.259	-.170	.018	.076	.385	.a	.379	.381	.368	.a	.442*	.416*	-.393*	-.420*	-.401*
	Sig. (2-tailed)	.201	.407	.931	.713	.052	.	.057	.055	.064	.	.024	.034	.047	.033	.042
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26

Correlations

		L_OR_ELD	ALM_RAT	SHA_RAT	FOL_RAT	POP_CA	L_POP_CA	POP_NCL	L_POP_NC	POP_BUT	L_POP_BT	PCI_CA_A	PCI_BT_A	UE_CA_U	UE_BUT_U	GAS_CA
TEMP_5	Pearson Correlation	.043	-.087	-.422*	-.353	.257	. ^a	.259	.251	.233	. ^a	.306	.269	-.208	-.264	-.055
	Sig. (2-tailed)	.835	.672	.032	.077	.204	.	.201	.216	.253	.	.128	.184	.307	.193	.790
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
TEMP_3	Pearson Correlation	.115	-.085	-.404*	-.174	.248	. ^a	.252	.243	.239	. ^a	.167	.220	-.101	-.220	-.065
	Sig. (2-tailed)	.575	.680	.040	.397	.221	.	.214	.232	.239	.	.415	.280	.624	.280	.752
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
TEMP_2LG	Pearson Correlation	.488*	-.019	-.142	-.012	-.028	. ^a	-.039	-.035	-.052	. ^a	.063	.019	-.059	-.046	-.084
	Sig. (2-tailed)	.011	.928	.490	.955	.891	.	.851	.864	.800	.	.759	.927	.776	.823	.682
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
PREC_ALL	Pearson Correlation	.022	.084	-.307	.059	.149	. ^a	.159	.169	.203	. ^a	-.008	-.026	.205	.128	.228
	Sig. (2-tailed)	.916	.682	.127	.776	.467	.	.439	.408	.321	.	.971	.899	.314	.534	.263
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
PREC_5	Pearson Correlation	-.169	.138	.199	.270	.094	. ^a	.096	.106	.130	. ^a	-.093	-.107	.199	.200	-.070
	Sig. (2-tailed)	.409	.502	.330	.182	.647	.	.640	.607	.526	.	.651	.604	.329	.328	.733
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
PREC_3	Pearson Correlation	-.311	.028	-.121	.180	.129	. ^a	.139	.136	.161	. ^a	-.112	-.099	.348	.262	.167
	Sig. (2-tailed)	.122	.893	.556	.379	.529	.	.499	.509	.431	.	.586	.632	.081	.197	.415
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
PREC_LG	Pearson Correlation	-.271	.350	-.206	.201	.295	. ^a	.304	.308	.320	. ^a	.177	.136	.017	-.003	-.050
	Sig. (2-tailed)	.191	.086	.322	.335	.153	.	.139	.134	.118	.	.398	.517	.934	.989	.811
	N	25	25	25	25	25	0	25	25	25	0	25	25	25	25	25
temp_ave_3lg	Pearson Correlation	.734**	-.099	-.252	-.057	-.039	. ^a	-.046	-.046	-.069	. ^a	.129	.116	-.207	-.153	-.014
	Sig. (2-tailed)	.000	.629	.214	.782	.851	.	.824	.825	.738	.	.530	.573	.310	.455	.948
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
PREC_AVE	Pearson Correlation	.022	.084	-.307	.059	.149	. ^a	.159	.169	.203	. ^a	-.008	-.026	.205	.128	.228
	Sig. (2-tailed)	.916	.682	.127	.776	.467	.	.439	.408	.321	.	.971	.899	.314	.534	.263
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
prec_ave_3lg	Pearson Correlation	-.222	.316	-.050	.252	.235	. ^a	.248	.238	.244	. ^a	.068	.084	.120	.105	-.113
	Sig. (2-tailed)	.277	.116	.809	.214	.248	.	.223	.243	.230	.	.742	.683	.560	.611	.581
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
AGE_55	Pearson Correlation	-.067	-.218	-.252	.121	.726**	. ^a	.724**	.751**	.777**	. ^a	.773**	.667**	-.419*	-.510**	-.085
	Sig. (2-tailed)	.746	.285	.215	.556	.000	.	.000	.000	.000	.	.000	.000	.033	.008	.679
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
ETH_WHT	Pearson Correlation	.000	.374	.340	-.244	-.998**	. ^a	-.998**	-.998**	-.992**	. ^a	-.897**	-.888**	.431*	.629**	.554**
	Sig. (2-tailed)	1.000	.060	.090	.231	.000	.	.000	.000	.000	.	.000	.000	.028	.001	.003
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
ETH_HSP	Pearson Correlation	-.007	-.315	-.278	.187	.927**	. ^a	.926**	.933**	.932**	. ^a	.859**	.812**	-.425*	-.570**	-.488*
	Sig. (2-tailed)	.974	.117	.169	.360	.000	.	.000	.000	.000	.	.000	.000	.031	.002	.011
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
BOAT_REG	Pearson Correlation	-.024	-.387	-.315	.250	.989**	. ^a	.990**	.985**	.975**	. ^a	.869**	.896**	-.424*	-.642**	-.597**
	Sig. (2-tailed)	.906	.051	.117	.219	.000	.	.000	.000	.000	.	.000	.000	.031	.000	.001
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
FSH_LIC	Pearson Correlation	.050	.458*	.238	-.322	-.940**	. ^a	-.936**	-.930**	-.917**	. ^a	-.826**	-.868**	.424*	.628**	.746**
	Sig. (2-tailed)	.809	.019	.243	.109	.000	.	.000	.000	.000	.	.000	.000	.031	.001	.000
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
FISH_STK	Pearson Correlation	-.170	.298	.307	.162	.179	. ^a	.201	.169	.138	. ^a	.010	.070	.011	.105	-.096
	Sig. (2-tailed)	.417	.148	.136	.439	.392	.	.335	.421	.511	.	.962	.739	.959	.617	.648
	N	25	25	25	25	25	0	25	25	25	0	25	25	25	25	25

Correlations

		L_OR_ELD	ALM_RAT	SHA_RAT	FOL_RAT	POP_CA	L_POP_CA	POP_NCL	L_POP_NC	POP_BUT	L_POP_BT	PCI_CA_A	PCI_BT_A	UE_CA_U	UE_BUT_U	GAS_CA
FSTK_LAG	Pearson Correlation	.192	.076	.033	.017	.165	.a	.190	.158	.117	.a	.188	.240	-.268	-.177	-.094
	Sig. (2-tailed)	.358	.719	.877	.937	.430	.	.363	.450	.578	.	.369	.249	.196	.397	.655
	N	25	25	25	25	25	0	25	25	25	0	25	25	25	25	25
IV_ELEV	Pearson Correlation	.025	-.282	-.188	.265	.773**	.a	.767**	.790**	.808**	.a	.696**	.569**	-.220	-.349	-.347
	Sig. (2-tailed)	.902	.163	.358	.191	.000	.	.000	.000	.000	.	.000	.002	.281	.080	.083
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
IV_GAS	Pearson Correlation	.075	-.258	-.209	.085	.603**	.a	.599**	.623**	.646**	.a	.541**	.377	-.064	-.182	-.053
	Sig. (2-tailed)	.717	.202	.304	.678	.001	.	.001	.001	.000	.	.004	.058	.755	.373	.798
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
IV_LGYR	Pearson Correlation	.027	-.394*	-.262	.252	.906**	.a	.899**	.915**	.924**	.a	.817**	.734**	-.307	-.487*	-.485*
	Sig. (2-tailed)	.898	.046	.197	.215	.000	.	.000	.000	.000	.	.000	.000	.127	.012	.012
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
IVF_ELEV	Pearson Correlation	-.022	-.236	-.202	.240	.720**	.a	.716**	.742**	.769**	.a	.653**	.539**	-.240	-.369	-.116
	Sig. (2-tailed)	.916	.247	.322	.238	.000	.	.000	.000	.000	.	.000	.005	.238	.064	.573
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
IVF_GAS	Pearson Correlation	.008	-.174	-.214	.033	.472*	.a	.472*	.498**	.532**	.a	.430*	.294	-.076	-.183	.284
	Sig. (2-tailed)	.969	.395	.295	.873	.015	.	.015	.010	.005	.	.028	.145	.713	.372	.160
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26
IVF_LGYR	Pearson Correlation	-.003	-.377	-.279	.241	.897**	.a	.892**	.909**	.924**	.a	.812**	.737**	-.330	-.516**	-.352
	Sig. (2-tailed)	.987	.057	.167	.236	.000	.	.000	.000	.000	.	.000	.000	.100	.007	.078
	N	26	26	26	26	26	0	26	26	26	0	26	26	26	26	26

Correlations

		L_GAS_CA	TEMP_MAX	TEMP_5	TEMP_3	TEMP_2LG	PREC_ALL	PREC_5	PREC_3	PREC_LG	temp_ave_3lg	PREC_AVE	prec_ave_3lg	AGE_55	ETH_WHT	ETH_HSP
YEAR	Pearson Correlation	-.536**	.381	.265	.249	-.038	.166	.096	.138	.321	-.044	.166	.257	.736**	-.997**	.930**
	Sig. (2-tailed)	.005	.055	.191	.220	.854	.419	.640	.502	.118	.832	.419	.204	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
L_YEAR	Pearson Correlation	-.444*	.340	.151	.120	-.062	.234	.133	.141	.337	-.054	.234	.204	.912**	-.926**	.904**
	Sig. (2-tailed)	.023	.089	.463	.561	.763	.250	.518	.492	.099	.792	.250	.317	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
DV_7980	Pearson Correlation	-.212	.279	.238	.129	.004	.303	.172	.118	.363	-.037	.303	.058	.857**	-.752**	.772**
	Sig. (2-tailed)	.299	.167	.241	.531	.985	.133	.402	.565	.074	.858	.133	.779	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
DV_8081	Pearson Correlation	-.409*	.253	.251	.175	.141	.323	.202	.156	.318	.047	.323	.105	.765**	-.805**	.820**
	Sig. (2-tailed)	.038	.212	.215	.392	.491	.107	.323	.446	.122	.818	.107	.611	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
ORO_EL	Pearson Correlation	.287	-.068	.088	.022	-.110	.227	.164	.101	.654**	-.241	.227	.441*	.045	.071	-.047
	Sig. (2-tailed)	.155	.740	.668	.916	.593	.264	.425	.622	.000	.236	.264	.024	.828	.731	.820
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
L_ORO_EL	Pearson Correlation	.282	-.066	.092	.022	-.096	.229	.166	.102	.647**	-.225	.229	.433*	.042	.068	-.043
	Sig. (2-tailed)	.163	.750	.655	.914	.641	.261	.417	.621	.000	.270	.261	.027	.839	.742	.834
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
ORO_EL_J	Pearson Correlation	.215	.013	.129	-.019	.000	-.047	.111	-.134	.691**	-.198	-.047	.424*	-.047	.022	-.033
	Sig. (2-tailed)	.292	.949	.529	.925	.999	.820	.588	.515	.000	.331	.820	.031	.819	.917	.873
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
L_OREL_J	Pearson Correlation	.210	.015	.126	-.021	.019	-.047	.119	-.139	.682**	-.184	-.047	.411*	-.035	.012	-.021
	Sig. (2-tailed)	.302	.944	.539	.920	.925	.820	.563	.498	.000	.369	.820	.037	.864	.954	.920
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
ORO_EL5	Pearson Correlation	.252	-.067	.146	.093	-.117	.237	.164	.099	.703**	-.267	.237	.478*	-.004	.047	-.031
	Sig. (2-tailed)	.214	.744	.478	.650	.571	.244	.423	.630	.000	.187	.244	.014	.983	.818	.881
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
L_OR_EL5	Pearson Correlation	.249	-.065	.148	.094	-.101	.238	.166	.097	.696**	-.250	.238	.469*	-.001	.044	-.026
	Sig. (2-tailed)	.219	.753	.470	.649	.623	.241	.417	.637	.000	.218	.241	.016	.996	.833	.900
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
ORO_EL3	Pearson Correlation	.222	.024	.116	-.039	-.055	-.043	.124	-.108	.713**	-.272	-.043	.452*	-.050	.041	-.049
	Sig. (2-tailed)	.277	.908	.572	.851	.788	.833	.546	.601	.000	.179	.833	.021	.809	.843	.813
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
L_OR_EL3	Pearson Correlation	.218	.026	.116	-.039	-.034	-.044	.130	-.115	.704**	-.254	-.044	.438*	-.039	.031	-.037
	Sig. (2-tailed)	.284	.901	.572	.851	.871	.832	.526	.577	.000	.211	.832	.025	.849	.879	.858
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
ORO_EL_2	Pearson Correlation	.184	-.185	.125	.266	-.162	.585**	.153	.391*	.349	-.134	.585**	.296	.072	.036	.013
	Sig. (2-tailed)	.369	.366	.542	.189	.429	.002	.456	.048	.088	.513	.002	.142	.726	.861	.950
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
L_OR_EL2	Pearson Correlation	.180	-.174	.139	.271	-.156	.581**	.144	.385	.354	-.127	.581**	.292	.079	.028	.020
	Sig. (2-tailed)	.379	.394	.498	.181	.448	.002	.483	.052	.082	.536	.002	.147	.702	.890	.924
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
ORO_EL_D	Pearson Correlation	-.042	-.151	.143	.187	.496*	-.018	-.168	-.269	-.225	.695**	-.018	-.228	-.037	-.129	.097
	Sig. (2-tailed)	.837	.463	.485	.361	.010	.931	.413	.183	.280	.000	.931	.263	.856	.531	.638
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
L_OR_ELD	Pearson Correlation	.035	-.259	.043	.115	.488*	.022	-.169	-.311	-.271	.734**	.022	-.222	-.067	.000	-.007
	Sig. (2-tailed)	.865	.201	.835	.575	.011	.916	.409	.122	.191	.000	.916	.277	.746	1.000	.974
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26

Correlations

		L_GAS_CA	TEMP_MAX	TEMP_5	TEMP_3	TEMP_2LG	PREC_ALL	PREC_5	PREC_3	PREC_LG	temp_ave_3lg	PREC_AVE	prec_ave_3lg	AGE_55	ETH_WHT	ETH_HSP
ALM_RAT	Pearson Correlation	.351	-.170	-.087	-.085	-.019	.084	.138	.028	.350	-.099	.084	.316	-.218	.374	-.315
	Sig. (2-tailed)	.079	.407	.672	.680	.928	.682	.502	.893	.086	.629	.682	.116	.285	.060	.117
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
SHA_RAT	Pearson Correlation	-.013	.018	-.422*	-.404*	-.142	-.307	.199	-.121	-.206	-.252	-.307	-.050	-.252	.340	-.278
	Sig. (2-tailed)	.949	.931	.032	.040	.490	.127	.330	.556	.322	.214	.127	.809	.215	.090	.169
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
FOL_RAT	Pearson Correlation	-.392*	.076	-.353	-.174	-.012	.059	.270	.180	.201	-.057	.059	.252	.121	-.244	.187
	Sig. (2-tailed)	.048	.713	.077	.397	.955	.776	.182	.379	.335	.782	.776	.214	.556	.231	.360
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
POP_CA	Pearson Correlation	-.569**	.385	.257	.248	-.028	.149	.094	.129	.295	-.039	.149	.235	.726**	-.998**	.927**
	Sig. (2-tailed)	.002	.052	.204	.221	.891	.467	.647	.529	.153	.851	.467	.248	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
L_POP_CA	Pearson Correlation	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POP_NCL	Pearson Correlation	-.554**	.379	.259	.252	-.039	.159	.096	.139	.304	-.046	.159	.248	.724**	-.998**	.926**
	Sig. (2-tailed)	.003	.057	.201	.214	.851	.439	.640	.499	.139	.824	.439	.223	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
L_POP_NC	Pearson Correlation	-.556**	.381	.251	.243	-.035	.169	.106	.136	.308	-.046	.169	.238	.751**	-.998**	.933**
	Sig. (2-tailed)	.003	.055	.216	.232	.864	.408	.607	.509	.134	.825	.408	.243	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
POP_BUT	Pearson Correlation	-.540**	.368	.233	.239	-.052	.203	.130	.161	.320	-.069	.203	.244	.777**	-.992**	.932**
	Sig. (2-tailed)	.004	.064	.253	.239	.800	.321	.526	.431	.118	.738	.321	.230	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
L_POP_BT	Pearson Correlation	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCI_CA_A	Pearson Correlation	-.535**	.442*	.306	.167	.063	-.008	-.093	-.112	.177	.129	-.008	.068	.773**	-.897**	.859**
	Sig. (2-tailed)	.005	.024	.128	.415	.759	.971	.651	.586	.398	.530	.971	.742	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
PCI_BT_A	Pearson Correlation	-.598**	.416*	.269	.220	.019	-.026	-.107	-.099	.136	.116	-.026	.084	.667**	-.888**	.812**
	Sig. (2-tailed)	.001	.034	.184	.280	.927	.899	.604	.632	.517	.573	.899	.683	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
UE_CA_U	Pearson Correlation	.371	-.393*	-.208	-.101	-.059	.205	.199	.348	.017	-.207	.205	.120	-.419*	.431*	-.425*
	Sig. (2-tailed)	.062	.047	.307	.624	.776	.314	.329	.081	.934	.310	.314	.560	.033	.028	.031
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
UE_BUT_U	Pearson Correlation	.460*	-.420*	-.264	-.220	-.046	.128	.200	.262	-.003	-.153	.128	.105	-.510**	.629**	-.570**
	Sig. (2-tailed)	.018	.033	.193	.280	.823	.534	.328	.197	.989	.455	.534	.611	.008	.001	.002
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
GAS_CA	Pearson Correlation	.995**	-.401*	-.055	-.065	-.084	.228	-.070	.167	-.050	-.014	.228	-.113	-.085	.554**	-.488*
	Sig. (2-tailed)	.000	.042	.790	.752	.682	.263	.733	.415	.811	.948	.263	.581	.679	.003	.011
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
L_GAS_CA	Pearson Correlation	1	-.391*	-.040	-.054	-.055	.206	-.063	.162	-.082	.001	.206	-.124	-.134	.577**	-.504**
	Sig. (2-tailed)	.	.048	.846	.794	.789	.314	.758	.429	.697	.998	.314	.548	.515	.002	.009
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
TEMP_MAX	Pearson Correlation	-.391*	1	.654**	.210	-.048	-.560**	-.217	-.450*	.082	-.225	-.560**	.089	.240	-.397*	.384
	Sig. (2-tailed)	.048	.	.000	.303	.815	.003	.286	.021	.696	.269	.003	.665	.237	.044	.053
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26

Correlations

		L_GAS_CA	TEMP_MAX	TEMP_5	TEMP_3	TEMP_2LG	PREC_ALL	PREC_5	PREC_3	PREC_LG	temp_ave_3lg	PREC_AVE	prec_ave_3lg	AGE_55	ETH_WHT	ETH_HSP
TEMP_5	Pearson Correlation	-.040	.654**	1	.654**	.033	-.267	-.481*	-.378	.156	-.019	-.267	.119	.133	-.269	.247
	Sig. (2-tailed)	.846	.000	.	.000	.874	.187	.013	.057	.457	.926	.187	.563	.518	.184	.225
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
TEMP_3	Pearson Correlation	-.054	.210	.654**	1	.050	-.016	-.364	-.152	.049	.042	-.016	.045	.049	-.249	.142
	Sig. (2-tailed)	.794	.303	.000	.	.807	.940	.067	.458	.818	.838	.940	.827	.813	.221	.489
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
TEMP_2LG	Pearson Correlation	-.055	-.048	.033	.050	1	.066	.208	-.061	-.325	.795**	.066	-.415*	-.099	.010	.024
	Sig. (2-tailed)	.789	.815	.874	.807	.	.747	.308	.768	.113	.000	.747	.035	.630	.960	.907
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
PREC_ALL	Pearson Correlation	.206	-.560**	-.267	-.016	.066	1	.481*	.774**	.090	.122	1.000**	.077	.307	-.151	.221
	Sig. (2-tailed)	.314	.003	.187	.940	.747	.	.013	.000	.667	.551	.	.709	.127	.463	.277
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
PREC_5	Pearson Correlation	-.063	-.217	-.481*	-.364	.208	.481*	1	.536**	.015	-.047	.481*	-.065	.058	-.106	.275
	Sig. (2-tailed)	.758	.286	.013	.067	.308	.013	.	.005	.942	.818	.013	.754	.780	.606	.174
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
PREC_3	Pearson Correlation	.162	-.450*	-.378	-.152	-.061	.774**	.536**	1	.010	-.077	.774**	.018	.107	-.120	.159
	Sig. (2-tailed)	.429	.021	.057	.458	.768	.000	.005	.	.963	.709	.000	.931	.602	.560	.438
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
PREC_LG	Pearson Correlation	-.082	.082	.156	.049	-.325	.090	.015	.010	1	-.473*	.090	.722**	.344	-.304	.205
	Sig. (2-tailed)	.697	.696	.457	.818	.113	.667	.942	.963	.	.017	.667	.000	.092	.139	.326
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
temp_ave_3lg	Pearson Correlation	.001	-.225	-.019	.042	.795**	.122	-.047	-.077	-.473*	1	.122	-.432*	-.053	.029	.002
	Sig. (2-tailed)	.998	.269	.926	.838	.000	.551	.818	.709	.017	.	.551	.028	.797	.887	.994
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
PREC_AVE	Pearson Correlation	.206	-.560**	-.267	-.016	.066	1.000**	.481*	.774**	.090	.122	1	.077	.307	-.151	.221
	Sig. (2-tailed)	.314	.003	.187	.940	.747	.	.013	.000	.667	.551	.	.709	.127	.463	.277
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
prec_ave_3lg	Pearson Correlation	-.124	.089	.119	.045	-.415*	.077	-.065	.018	.722**	-.432*	.077	1	.135	-.232	.116
	Sig. (2-tailed)	.548	.665	.563	.827	.035	.709	.754	.931	.000	.028	.709	.	.511	.255	.572
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
AGE_55	Pearson Correlation	-.134	.240	.133	.049	-.099	.307	.058	.107	.344	-.053	.307	.135	1	-.727**	.742**
	Sig. (2-tailed)	.515	.237	.518	.813	.630	.127	.780	.602	.092	.797	.127	.511	.	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
ETH_WHT	Pearson Correlation	.577**	-.397*	-.269	-.249	.010	-.151	-.106	-.120	-.304	.029	-.151	-.232	-.727**	1	-.937**
	Sig. (2-tailed)	.002	.044	.184	.221	.960	.463	.606	.560	.139	.887	.463	.255	.000	.	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
ETH_HSP	Pearson Correlation	-.504**	.384	.247	.142	.024	.221	.275	.159	.205	.002	.221	.116	.742**	-.937**	1
	Sig. (2-tailed)	.009	.053	.225	.489	.907	.277	.174	.438	.326	.994	.277	.572	.000	.000	.
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
BOAT_REG	Pearson Correlation	-.616**	.410*	.229	.241	-.043	.096	.103	.115	.252	-.068	.096	.226	.652**	-.986**	.905**
	Sig. (2-tailed)	.001	.038	.260	.236	.834	.639	.616	.577	.223	.740	.639	.266	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
FSH_LIC	Pearson Correlation	.762**	-.443*	-.202	-.224	.024	-.009	-.063	-.085	-.161	.023	-.009	-.183	-.520**	.939**	-.847**
	Sig. (2-tailed)	.000	.023	.322	.272	.906	.964	.761	.679	.442	.910	.964	.370	.006	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
FISH_STK	Pearson Correlation	-.077	.043	-.124	-.066	-.350	-.133	.095	.118	.132	-.290	-.133	.242	-.136	-.186	.176
	Sig. (2-tailed)	.715	.839	.555	.755	.087	.525	.650	.574	.539	.159	.525	.244	.517	.374	.399
	N	25	25	25	25	25	25	25	25	24	25	25	25	25	25	25

Correlations

		L_GAS_CA	TEMP_MAX	TEMP_5	TEMP_3	TEMP_2LG	PREC_ALL	PREC_5	PREC_3	PREC_LG	temp_ave_3lg	PREC_AVE	prec_ave_3lg	AGE_55	ETH_WHT	ETH_HSP
FSTK_LAG	Pearson Correlation	-.085	.026	-.014	-.015	-.121	.008	.050	.076	-.101	.010	.008	.171	-.065	-.177	.135
	Sig. (2-tailed)	.686	.902	.947	.944	.566	.969	.813	.717	.630	.964	.969	.414	.758	.397	.521
	N	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
IV_ELEV	Pearson Correlation	-.384	.247	.250	.166	.124	.346	.227	.176	.374	.022	.346	.153	.756**	-.794**	.811**
	Sig. (2-tailed)	.053	.224	.218	.418	.546	.084	.265	.390	.065	.916	.084	.455	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
IV_GAS	Pearson Correlation	-.085	.084	.258	.170	.167	.445*	.201	.265	.291	.080	.445*	.086	.712**	-.621**	.664**
	Sig. (2-tailed)	.681	.685	.204	.407	.416	.023	.325	.190	.158	.696	.023	.676	.000	.001	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
IV_LGYR	Pearson Correlation	-.517**	.327	.274	.218	.099	.262	.179	.145	.322	.022	.262	.156	.763**	-.919**	.903**
	Sig. (2-tailed)	.007	.103	.175	.285	.629	.197	.381	.479	.117	.914	.197	.448	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
IVF_ELEV	Pearson Correlation	-.175	.272	.235	.116	-.020	.324	.196	.137	.423*	-.068	.324	.107	.847**	-.733**	.756**
	Sig. (2-tailed)	.394	.179	.248	.572	.921	.107	.338	.505	.035	.743	.107	.605	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
IVF_GAS	Pearson Correlation	.225	.100	.217	.089	-.040	.387	.141	.197	.324	-.043	.387	.011	.776**	-.478*	.527**
	Sig. (2-tailed)	.269	.626	.286	.665	.848	.051	.492	.334	.115	.835	.051	.956	.000	.014	.006
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26
IVF_LGYR	Pearson Correlation	-.398*	.354	.272	.193	.008	.251	.162	.122	.360	-.035	.251	.129	.840**	-.905**	.892**
	Sig. (2-tailed)	.044	.076	.179	.346	.970	.217	.430	.551	.077	.866	.217	.530	.000	.000	.000
	N	26	26	26	26	26	26	26	26	25	26	26	26	26	26	26

Correlations

		BOAT_REG	FSH_LIC	FISH_STK	FSTK_LAG	IV_ELEV	IV_GAS	IV_LGYR	IVF_ELEV	IVF_GAS	IVF_LGYR
YEAR	Pearson Correlation	.985**	-.927**	.219	.215	.772**	.607**	.899**	.724**	.483*	.893**
	Sig. (2-tailed)	.000	.000	.293	.301	.000	.001	.000	.000	.012	.000
	N	26	26	25	25	26	26	26	26	26	26
L_YEAR	Pearson Correlation	.883**	-.806**	.067	.070	.839**	.705**	.908**	.830**	.628**	.926**
	Sig. (2-tailed)	.000	.000	.751	.739	.000	.000	.000	.000	.001	.000
	N	26	26	25	25	26	26	26	26	26	26
DV_7980	Pearson Correlation	.663**	-.572**	-.123	-.180	.897**	.840**	.878**	.994**	.900**	.960**
	Sig. (2-tailed)	.000	.002	.559	.390	.000	.000	.000	.000	.000	.000
	N	26	26	25	25	26	26	26	26	26	26
DV_8081	Pearson Correlation	.716**	-.665**	-.159	-.121	.994**	.931**	.973**	.887**	.708**	.926**
	Sig. (2-tailed)	.000	.000	.447	.566	.000	.000	.000	.000	.000	.000
	N	26	26	25	25	26	26	26	26	26	26
ORO_EL	Pearson Correlation	-.110	.237	.202	.070	.052	.053	-.064	.137	.164	-.015
	Sig. (2-tailed)	.592	.244	.332	.739	.802	.798	.755	.505	.424	.943
	N	26	26	25	25	26	26	26	26	26	26
L_ORO_EL	Pearson Correlation	-.108	.233	.202	.077	.054	.054	-.062	.138	.162	-.013
	Sig. (2-tailed)	.601	.253	.332	.716	.792	.795	.765	.502	.428	.950
	N	26	26	25	25	26	26	26	26	26	26
ORO_EL_J	Pearson Correlation	-.047	.177	.146	.018	.050	.048	-.029	.096	.106	-.002
	Sig. (2-tailed)	.821	.387	.485	.931	.810	.817	.890	.642	.606	.992
	N	26	26	25	25	26	26	26	26	26	26
L_OREL_J	Pearson Correlation	-.038	.170	.138	.015	.061	.059	-.016	.109	.118	.011
	Sig. (2-tailed)	.853	.406	.509	.942	.765	.774	.937	.597	.565	.956
	N	26	26	25	25	26	26	26	26	26	26
ORO_EL5	Pearson Correlation	-.080	.207	.157	.086	.046	.042	-.053	.112	.128	-.015
	Sig. (2-tailed)	.697	.311	.454	.681	.824	.837	.796	.587	.533	.942
	N	26	26	25	25	26	26	26	26	26	26
L_OR_EL5	Pearson Correlation	-.077	.203	.156	.089	.051	.047	-.048	.117	.132	-.010
	Sig. (2-tailed)	.708	.319	.457	.673	.804	.821	.815	.569	.521	.961
	N	26	26	25	25	26	26	26	26	26	26
ORO_EL3	Pearson Correlation	-.064	.192	.173	.003	.033	.028	-.049	.087	.098	-.018
	Sig. (2-tailed)	.755	.348	.408	.987	.871	.893	.812	.673	.635	.929
	N	26	26	25	25	26	26	26	26	26	26
L_OR_EL3	Pearson Correlation	-.056	.185	.165	.002	.045	.040	-.037	.100	.110	-.005
	Sig. (2-tailed)	.787	.365	.429	.993	.826	.847	.858	.629	.594	.980
	N	26	26	25	25	26	26	26	26	26	26
ORO_EL_2	Pearson Correlation	-.069	.134	.055	.181	.044	.046	-.035	.100	.118	-.003
	Sig. (2-tailed)	.739	.514	.793	.387	.830	.822	.865	.628	.567	.989
	N	26	26	25	25	26	26	26	26	26	26
L_OR_EL2	Pearson Correlation	-.062	.128	.053	.168	.053	.053	-.027	.108	.124	.006
	Sig. (2-tailed)	.763	.534	.801	.421	.799	.797	.897	.600	.546	.977
	N	26	26	25	25	26	26	26	26	26	26
ORO_EL_D	Pearson Correlation	.108	-.087	-.267	.159	.111	.149	.142	.038	.042	.100
	Sig. (2-tailed)	.599	.673	.198	.448	.590	.467	.488	.853	.839	.628
	N	26	26	25	25	26	26	26	26	26	26
L_OR_ELD	Pearson Correlation	-.024	.050	-.170	.192	.025	.075	.027	-.022	.008	-.003
	Sig. (2-tailed)	.906	.809	.417	.358	.902	.717	.898	.916	.969	.987
	N	26	26	25	25	26	26	26	26	26	26

Correlations

		BOAT_REG	FSH_LIC	FISH_STK	FSTK_LAG	IV_ELEV	IV_GAS	IV_LGYR	IVF_ELEV	IVF_GAS	IVF_LGYR
ALM_RAT	Pearson Correlation	-.387	.458*	.298	.076	-.282	-.258	-.394*	-.236	-.174	-.377
	Sig. (2-tailed)	.051	.019	.148	.719	.163	.202	.046	.247	.395	.057
	N	26	26	25	25	26	26	26	26	26	26
SHA_RAT	Pearson Correlation	-.315	.238	.307	.033	-.188	-.209	-.262	-.202	-.214	-.279
	Sig. (2-tailed)	.117	.243	.136	.877	.358	.304	.197	.322	.295	.167
	N	26	26	25	25	26	26	26	26	26	26
FOL_RAT	Pearson Correlation	.250	-.322	.162	.017	.265	.085	.252	.240	.033	.241
	Sig. (2-tailed)	.219	.109	.439	.937	.191	.678	.215	.238	.873	.236
	N	26	26	25	25	26	26	26	26	26	26
POP_CA	Pearson Correlation	.989**	-.940**	.179	.165	.773**	.603**	.906**	.720**	.472*	.897**
	Sig. (2-tailed)	.000	.000	.392	.430	.000	.001	.000	.000	.015	.000
	N	26	26	25	25	26	26	26	26	26	26
L_POP_CA	Pearson Correlation	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.
	N	0	0	0	0	0	0	0	0	0	0
POP_NCL	Pearson Correlation	.990**	-.936**	.201	.190	.767**	.599**	.899**	.716**	.472*	.892**
	Sig. (2-tailed)	.000	.000	.335	.363	.000	.001	.000	.000	.015	.000
	N	26	26	25	25	26	26	26	26	26	26
L_POP_NC	Pearson Correlation	.985**	-.930**	.169	.158	.790**	.623**	.915**	.742**	.498**	.909**
	Sig. (2-tailed)	.000	.000	.421	.450	.000	.001	.000	.000	.010	.000
	N	26	26	25	25	26	26	26	26	26	26
POP_BUT	Pearson Correlation	.975**	-.917**	.138	.117	.808**	.646**	.924**	.769**	.532**	.924**
	Sig. (2-tailed)	.000	.000	.511	.578	.000	.000	.000	.000	.005	.000
	N	26	26	25	25	26	26	26	26	26	26
L_POP_BT	Pearson Correlation	.a	.a	.a	.a	.a	.a	.a	.a	.a	.a
	Sig. (2-tailed)	.	.	.	.	.	.	.	.	.	.
	N	0	0	0	0	0	0	0	0	0	0
PCI_CA_A	Pearson Correlation	.869**	-.826**	.010	.188	.696**	.541**	.817**	.653**	.430*	.812**
	Sig. (2-tailed)	.000	.000	.962	.369	.000	.004	.000	.000	.028	.000
	N	26	26	25	25	26	26	26	26	26	26
PCI_BT_A	Pearson Correlation	.896**	-.868**	.070	.240	.569**	.377	.734**	.539**	.294	.737**
	Sig. (2-tailed)	.000	.000	.739	.249	.002	.058	.000	.005	.145	.000
	N	26	26	25	25	26	26	26	26	26	26
UE_CA_U	Pearson Correlation	-.424*	.424*	.011	-.268	-.220	-.064	-.307	-.240	-.076	-.330
	Sig. (2-tailed)	.031	.031	.959	.196	.281	.755	.127	.238	.713	.100
	N	26	26	25	25	26	26	26	26	26	26
UE_BUT_U	Pearson Correlation	-.642**	.628**	.105	-.177	-.349	-.182	-.487*	-.369	-.183	-.516**
	Sig. (2-tailed)	.000	.001	.617	.397	.080	.373	.012	.064	.372	.007
	N	26	26	25	25	26	26	26	26	26	26
GAS_CA	Pearson Correlation	-.597**	.746**	-.096	-.094	-.347	-.053	-.485*	-.116	.284	-.352
	Sig. (2-tailed)	.001	.000	.648	.655	.083	.798	.012	.573	.160	.078
	N	26	26	25	25	26	26	26	26	26	26
L_GAS_CA	Pearson Correlation	-.616**	.762**	-.077	-.085	-.384	-.085	-.517**	-.175	.225	-.398*
	Sig. (2-tailed)	.001	.000	.715	.686	.053	.681	.007	.394	.269	.044
	N	26	26	25	25	26	26	26	26	26	26
TEMP_MAX	Pearson Correlation	.410*	-.443*	.043	.026	.247	.084	.327	.272	.100	.354
	Sig. (2-tailed)	.038	.023	.839	.902	.224	.685	.103	.179	.626	.076
	N	26	26	25	25	26	26	26	26	26	26

Correlations

		BOAT_REG	FSH_LIC	FISH_STK	FSTK_LAG	IV_ELEV	IV_GAS	IV_LGYR	IVF_ELEV	IVF_GAS	IVF_LGYR
TEMP_5	Pearson Correlation	.229	-.202	-.124	-.014	.250	.258	.274	.235	.217	.272
	Sig. (2-tailed)	.260	.322	.555	.947	.218	.204	.175	.248	.286	.179
	N	26	26	25	25	26	26	26	26	26	26
TEMP_3	Pearson Correlation	.241	-.224	-.066	-.015	.166	.170	.218	.116	.089	.193
	Sig. (2-tailed)	.236	.272	.755	.944	.418	.407	.285	.572	.665	.346
	N	26	26	25	25	26	26	26	26	26	26
TEMP_2LG	Pearson Correlation	-.043	.024	-.350	-.121	.124	.167	.099	-.020	-.040	.008
	Sig. (2-tailed)	.834	.906	.087	.566	.546	.416	.629	.921	.848	.970
	N	26	26	25	25	26	26	26	26	26	26
PREC_ALL	Pearson Correlation	.096	-.009	-.133	.008	.346	.445*	.262	.324	.387	.251
	Sig. (2-tailed)	.639	.964	.525	.969	.084	.023	.197	.107	.051	.217
	N	26	26	25	25	26	26	26	26	26	26
PREC_5	Pearson Correlation	.103	-.063	.095	.050	.227	.201	.179	.196	.141	.162
	Sig. (2-tailed)	.616	.761	.650	.813	.265	.325	.381	.338	.492	.430
	N	26	26	25	25	26	26	26	26	26	26
PREC_3	Pearson Correlation	.115	-.085	.118	.076	.176	.265	.145	.137	.197	.122
	Sig. (2-tailed)	.577	.679	.574	.717	.390	.190	.479	.505	.334	.551
	N	26	26	25	25	26	26	26	26	26	26
PREC_LG	Pearson Correlation	.252	-.161	.132	-.101	.374	.291	.322	.423*	.324	.360
	Sig. (2-tailed)	.223	.442	.539	.630	.065	.158	.117	.035	.115	.077
	N	25	25	24	25	25	25	25	25	25	25
temp_ave_3lg	Pearson Correlation	-.068	.023	-.290	.010	.022	.080	.022	-.068	-.043	-.035
	Sig. (2-tailed)	.740	.910	.159	.964	.916	.696	.914	.743	.835	.866
	N	26	26	25	25	26	26	26	26	26	26
PREC_AVE	Pearson Correlation	.096	-.009	-.133	.008	.346	.445*	.262	.324	.387	.251
	Sig. (2-tailed)	.639	.964	.525	.969	.084	.023	.197	.107	.051	.217
	N	26	26	25	25	26	26	26	26	26	26
prec_ave_3lg	Pearson Correlation	.226	-.183	.242	.171	.153	.086	.156	.107	.011	.129
	Sig. (2-tailed)	.266	.370	.244	.414	.455	.676	.448	.605	.956	.530
	N	26	26	25	25	26	26	26	26	26	26
AGE_55	Pearson Correlation	.652**	-.520**	-.136	-.065	.756**	.712**	.763**	.847**	.776**	.840**
	Sig. (2-tailed)	.000	.006	.517	.758	.000	.000	.000	.000	.000	.000
	N	26	26	25	25	26	26	26	26	26	26
ETH_WHT	Pearson Correlation	-.986**	.939**	-.186	-.177	-.794**	-.621**	-.919**	-.733**	-.478*	-.905**
	Sig. (2-tailed)	.000	.000	.374	.397	.000	.001	.000	.000	.014	.000
	N	26	26	25	25	26	26	26	26	26	26
ETH_HSP	Pearson Correlation	.905**	-.847**	.176	.135	.811**	.664**	.903**	.756**	.527**	.892**
	Sig. (2-tailed)	.000	.000	.399	.521	.000	.000	.000	.000	.006	.000
	N	26	26	25	25	26	26	26	26	26	26
BOAT_REG	Pearson Correlation	1	-.963**	.252	.215	.700**	.506**	.856**	.640**	.372	.842**
	Sig. (2-tailed)	.	.000	.225	.303	.000	.008	.000	.000	.061	.000
	N	26	26	25	25	26	26	26	26	26	26
FSH_LIC	Pearson Correlation	-.963**	1	-.257	-.197	-.642**	-.409*	-.812**	-.541**	-.224	-.771**
	Sig. (2-tailed)	.000	.	.214	.346	.000	.038	.000	.004	.271	.000
	N	26	26	25	25	26	26	26	26	26	26
FISH_STK	Pearson Correlation	.252	-.257	1	.467*	-.120	-.224	-.036	-.080	-.157	-.007
	Sig. (2-tailed)	.225	.214	.	.022	.567	.281	.865	.705	.452	.972
	N	25	25	25	24	25	25	25	25	25	25

Correlations

		BOAT_REG	FSH_LIC	FISH_STK	FSTK_LAG	IV_ELEV	IV_GAS	IV_LGYR	IVF_ELEV	IVF_GAS	IVF_LGYR
FSTK_LAG	Pearson Correlation	.215	-.197	.467*	1	-.080	-.125	-.017	-.138	-.195	-.052
	Sig. (2-tailed)	.303	.346	.022	.	.705	.552	.937	.512	.349	.805
	N	25	25	24	25	25	25	25	25	25	25
IV_ELEV	Pearson Correlation	.700**	-.642**	-.120	-.080	1	.937**	.964**	.894**	.715**	.917**
	Sig. (2-tailed)	.000	.000	.567	.705	.	.000	.000	.000	.000	.000
	N	26	26	25	25	26	26	26	26	26	26
IV_GAS	Pearson Correlation	.506**	-.409*	-.224	-.125	.937**	1	.850**	.837**	.791**	.803**
	Sig. (2-tailed)	.008	.038	.281	.552	.000	.	.000	.000	.000	.000
	N	26	26	25	25	26	26	26	26	26	26
IV_LGYR	Pearson Correlation	.856**	-.812**	-.036	-.017	.964**	.850**	1	.859**	.634**	.957**
	Sig. (2-tailed)	.000	.000	.865	.937	.000	.000	.	.000	.001	.000
	N	26	26	25	25	26	26	26	26	26	26
IVF_ELEV	Pearson Correlation	.640**	-.541**	-.080	-.138	.894**	.837**	.859**	1	.911**	.947**
	Sig. (2-tailed)	.000	.004	.705	.512	.000	.000	.000	.	.000	.000
	N	26	26	25	25	26	26	26	26	26	26
IVF_GAS	Pearson Correlation	.372	-.224	-.157	-.195	.715**	.791**	.634**	.911**	1	.773**
	Sig. (2-tailed)	.061	.271	.452	.349	.000	.000	.001	.000	.	.000
	N	26	26	25	25	26	26	26	26	26	26
IVF_LGYR	Pearson Correlation	.842**	-.771**	-.007	-.052	.917**	.803**	.957**	.947**	.773**	1
	Sig. (2-tailed)	.000	.000	.972	.805	.000	.000	.000	.000	.000	.
	N	26	26	25	25	26	26	26	26	26	26

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

a . Cannot be computed because at least one of the variables is constant.

APPENDIX B

ATTACHMENT E – MISCELLANEOUS MODEL RUNS

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Climate: Average Maximum Temperature (natural log)

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	L_TMP_MX, L_ORO_EL, L_YEAR ^a , L_GAS_CA	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.869 ^a	.755	.708	.304988189

a. Predictors: (Constant), L_TMP_MX, L_ORO_EL, L_YEAR, L_GAS_CA

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.007	4	1.502	16.145	.000 ^a
	Residual	1.953	21	.093		
	Total	7.960	25			

a. Predictors: (Constant), L_TMP_MX, L_ORO_EL, L_YEAR, L_GAS_CA

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-33.300	17.135		-1.943	.065
	L_YEAR	-.421	.081	-.641	-5.178	.000
	L_ORO_EL	2.934	1.092	.305	2.687	.014
	L_GAS_CA	.885	.390	.299	2.268	.034
	L_TMP_MX	3.743	3.640	.123	1.028	.316

a. Dependent Variable: OR_AL_PC

Climate: Average Temperature

Variables Entered/Removed^b

Model	Variables Entered	Variables Removed	Method
1	TMP_AVE, L_ORO_EL, L_YEAR ^a , L_GAS_CA	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.864 ^a	.746	.697	.310379126

a. Predictors: (Constant), TMP_AVE, L_ORO_EL, L_YEAR, L_GAS_CA

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.937	4	1.484	15.408	.000 ^a
	Residual	2.023	21	.096		
	Total	7.960	25			

a. Predictors: (Constant), TMP_AVE, L_ORO_EL, L_YEAR, L_GAS_CA

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-15.732	7.948		-1.979	.061
	L_YEAR	-.410	.082	-.624	-5.016	.000
	L_ORO_EL	3.019	1.115	.313	2.707	.013
	L_GAS_CA	.808	.387	.273	2.089	.049
	TMP_AVE	-3.21E-02	.059	-.063	-.546	.591

a. Dependent Variable: OR_AL_PC

Climate: Total Precipitation (natural log)

Variables Entered/Removed^b

Model	Variables Entered	Variables Removed	Method
1	L_PRC_A L, L_GAS_C A, L_ORO_E _a L, L_YEAR	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.864 ^a	.746	.698	.310204901

a. Predictors: (Constant), L_PRC_AL, L_GAS_CA, L_ORO_EL, L_YEAR

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.940	4	1.485	15.431	.000 ^a
	Residual	2.021	21	.096		
	Total	7.960	25			

a. Predictors: (Constant), L_PRC_AL, L_GAS_CA, L_ORO_EL, L_YEAR

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-18.001	7.471		-2.410	.025
	L_YEAR	-.386	.088	-.586	-4.376	.000
	L_ORO_EL	3.098	1.135	.322	2.730	.013
	L_GAS_CA	.822	.391	.278	2.102	.048
	L_PRC_AL	-9.25E-02	.163	-.070	-.567	.577

a. Dependent Variable: OR_AL_PC

Ethnicity - percent White

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	ETH_WHT, L_ORO_E L, DV_8384, L_GAS_C A, UE_BUT_ U	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.906 ^a	.820	.778	.27449

a. Predictors: (Constant), ETH_WHT, L_ORO_EL, DV_8384, L_GAS_CA, UE_BUT_U

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.222	5	1.444	19.171	.000 ^a
	Residual	1.582	21	.075		
	Total	8.805	26			

a. Predictors: (Constant), ETH_WHT, L_ORO_EL, DV_8384, L_GAS_CA, UE_BUT_U

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	-29.483	6.942		-4.247	.000
DV_8384	-1.180	.302	-.390	-3.904	.001
L_ORO_EL	3.191	.986	.321	3.237	.004
UE_BUT_U	-7.28E-02	.035	-.262	-2.052	.053
L_GAS_CA	.479	.372	.156	1.286	.212
ETH_WHT	.128	.021	.804	6.056	.000

a. Dependent Variable: OR_AL_PC

Ethnicity - percent Hispanic

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	ETH_HSP, L_ORO_EL, DV_8384, L_GAS_CA, UE_BUT_U	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.896 ^a	.803	.756	.28730

a. Predictors: (Constant), ETH_HSP, L_ORO_EL, DV_8384, L_GAS_CA, UE_BUT_U

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.071	5	1.414	17.134	.000 ^a
	Residual	1.733	21	.083		
	Total	8.805	26			

a. Predictors: (Constant), ETH_HSP, L_ORO_EL, DV_8384, L_GAS_CA, UE_BUT_U

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-16.727	6.829		-2.449	.023
	DV_8384	-1.248	.315	-.413	-3.960	.001
	L_ORO_EL	3.130	1.031	.315	3.036	.006
	UE_BUT_U	-5.35E-02	.036	-.193	-1.497	.149
	L_GAS_CA	.717	.375	.233	1.910	.070
	ETH_HSP	-.231	.041	-.712	-5.625	.000

a. Dependent Variable: OR_AL_PC

Age – percent 55 years and older

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	AGE_55, L_ORO_E L, DV_8384, L_GAS_C A, UE_BUT_ U	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.852 ^a	.726	.660	.33918

a. Predictors: (Constant), AGE_55, L_ORO_EL, DV_8384, L_GAS_CA, UE_BUT_U

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.389	5	1.278	11.107	.000 ^a
	Residual	2.416	21	.115		
	Total	8.805	26			

a. Predictors: (Constant), AGE_55, L_ORO_EL, DV_8384, L_GAS_CA, UE_BUT_U

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-3.889	8.500		-.458	.652
	DV_8384	-1.024	.383	-.339	-2.672	.014
	L_ORO_EL	2.843	1.212	.286	2.345	.029
	UE_BUT_U	-5.65E-02	.044	-.204	-1.284	.213
	L_GAS_CA	1.638	.417	.533	3.930	.001
	AGE_55	-.576	.141	-.553	-4.095	.001

a. Dependent Variable: OR_AL_PC

Fishing License Sales

Variables Entered/Removed^b

Model	Variables Entered	Variables Removed	Method
1	LG_FSHLC, DV_8384, L_ORO_EL, UE_BUT_U, L_GAS_CA ^a	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.850 ^a	.723	.657	.34079

a. Predictors: (Constant), LG_FSHLC, DV_8384, L_ORO_EL, UE_BUT_U, L_GAS_CA

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.366	5	1.273	10.962	.000 ^a
	Residual	2.439	21	.116		
	Total	8.805	26			

a. Predictors: (Constant), LG_FSHLC, DV_8384, L_ORO_EL, UE_BUT_U, L_GAS_CA

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	-37.115	9.759		-3.803	.001
DV_8384	-1.416	.372	-.468	-3.811	.001
L_ORO_EL	2.416	1.213	.243	1.992	.059
UE_BUT_U	-5.02E-02	.044	-.181	-1.154	.262
L_GAS_CA	8.122E-02	.538	.026	.151	.881
LG_FSHLC	2.213	.546	.802	4.052	.001

a. Dependent Variable: OR_AL_PC

Boat Registrations

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	LG_BTREG, L_ORO_EL, DV_8384, L_GAS_CA, UE_BT_U	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.879 ^a	.773	.719	.30874

a. Predictors: (Constant), LG_BTREG, L_ORO_EL, DV_8384, L_GAS_CA, UE_BT_U

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.803	5	1.361	14.274	.000 ^a
	Residual	2.002	21	.095		
	Total	8.805	26			

a. Predictors: (Constant), LG_BTREG, L_ORO_EL, DV_8384, L_GAS_CA, UE_BT_U

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	5.806	8.449		.687	.499
DV_8384	-1.315	.338	-.435	-3.895	.001
L_ORO_EL	2.844	1.103	.286	2.579	.017
UE_BUT_U	-6.72E-02	.040	-.242	-1.672	.109
L_GAS_CA	.394	.434	.128	.907	.375
LG_BTREG	-2.348	.474	-.789	-4.959	.000

a. Dependent Variable: OR_AL_PC

Fish Stocking

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	LG_FHSTK, DV_8384, L_YEAR, L_ORO_EL, L_GAS_CA, UE_BUT_U	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.892 ^a	.797	.735	.29928

a. Predictors: (Constant), LG_FHSTK, DV_8384, L_YEAR, L_ORO_EL, L_GAS_CA, UE_BUT_U

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.013	6	1.169	13.050	.000 ^a
	Residual	1.791	20	.090		
	Total	8.805	26			

a. Predictors: (Constant), LG_FHSTK, DV_8384, L_YEAR, L_ORO_EL, L_GAS_CA, UE_BUT_U

b. Dependent Variable: OR_AL_PC

APPENDIX B

ATTACHMENT F – LAKE OROVILLE RECREATION MODELS

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OROVILLE "PREFERRED" MODEL

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	IV_LGYR, L_ORO_E L	.	Enter

a. All requested variables entered.

b. Dependent Variable: ORO_ATT_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.909 ^a	.826	.810	.2406011

a. Predictors: (Constant), IV_LGYR, L_ORO_EL

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.300	2	3.150	54.412	.000 ^a
	Residual	1.331	23	.058		
	Total	7.631	25			

a. Predictors: (Constant), IV_LGYR, L_ORO_EL

b. Dependent Variable: ORO_ATT_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-19.055	5.523		-3.450	.002
	L_ORO_EL	3.229	.823	.342	3.924	.001
	IV_LGYR	-.345	.037	-.821	-9.406	.000

a. Dependent Variable: ORO_ATT_PC

Alternative 1

Variables Entered/Removed^d

Model	Variables Entered	Variables Removed	Method
1	IV_YEAR, L_ORO_EL, DV_8081 ^a	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.909 ^a	.826	.802	.25121

a. Predictors: (Constant), IV_YEAR, L_ORO_EL, DV_8081

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.572	3	2.191	34.714	.000 ^a
	Residual	1.388	22	.063		
	Total	7.960	25			

a. Predictors: (Constant), IV_YEAR, L_ORO_EL, DV_8081

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-20.657	5.765		-3.583	.002
	L_ORO_EL	3.470	.859	.360	4.038	.001
	DV_8081	-.384	.214	-.308	-1.798	.086
	IV_YEAR	-3.20E-02	.010	-.537	-3.130	.005

a. Dependent Variable: OR_AL_PC

Alternative 2

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	IV_ELEV, L_ORO_EL, IV_YEAR, DV_8081 ^a	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.925 ^a	.856	.828	.23380

a. Predictors: (Constant), IV_ELEV, L_ORO_EL, IV_YEAR, DV_8081

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.812	4	1.703	31.158	.000 ^a
	Residual	1.148	21	.055		
	Total	7.960	25			

a. Predictors: (Constant), IV_ELEV, L_ORO_EL, IV_YEAR, DV_8081

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-38.326	9.988		-3.837	.001
	L_ORO_EL	6.103	1.489	.634	4.100	.001
	IV_YEAR	-3.28E-02	.010	-.550	-3.442	.002
	DV_8081	3.469	1.848	2.781	1.877	.074
	IV_ELEV	-4.68E-03	.002	-3.085	-2.097	.048

a. Dependent Variable: OR_AL_PC

Alternative 3

Variables Entered/Removed^d

Model	Variables Entered	Variables Removed	Method
1	IV_ELEV, L_ORO_EL ^a IV_YEAR	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.912 ^a	.832	.809	.24684

a. Predictors: (Constant), IV_ELEV, L_ORO_EL, IV_YEAR

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.620	3	2.207	36.215	.000 ^a
	Residual	1.340	22	.061		
	Total	7.960	25			

a. Predictors: (Constant), IV_ELEV, L_ORO_EL, IV_YEAR

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-22.625	5.764		-3.925	.001
	L_ORO_EL	3.764	.860	.391	4.377	.000
	IV_YEAR	-3.04E-02	.010	-.511	-3.054	.006
	IV_ELEV	-5.16E-04	.000	-.340	-2.033	.054

a. Dependent Variable: OR_AL_PC

Alternative 4

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	DV_8081, L_ORO_E L	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.865 ^a	.748	.726	*****

a. Predictors: (Constant), DV_8081, L_ORO_EL

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.954	2	2.977	34.124	.000 ^a
	Residual	2.006	23	.087		
	Total	7.960	25			

a. Predictors: (Constant), DV_8081, L_ORO_EL

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-21.608	6.769		-3.192	.004
	L_ORO_EL	3.611	1.009	.375	3.580	.002
	DV_8081	-.956	.131	-.767	-7.318	.000

a. Dependent Variable: OR_AL_PC

“BASE” MODEL

Variables Entered/Removed^b

Model	Variables Entered	Variables Removed	Method
1	L_GAS_CA, L_ORO_EL, L_YEAR ^a	.	Enter

a. All requested variables entered.

b. Dependent Variable: OR_AL_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.862 ^a	.742	.707	.30539

a. Predictors: (Constant), L_GAS_CA, L_ORO_EL, L_YEAR

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.909	3	1.970	21.119	.000 ^a
	Residual	2.052	22	.093		
	Total	7.960	25			

a. Predictors: (Constant), L_GAS_CA, L_ORO_EL, L_YEAR

b. Dependent Variable: OR_AL_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-17.338	7.264		-2.387	.026
	L_YEAR	-.405	.080	-.616	-5.068	.000
	L_ORO_EL	2.964	1.093	.308	2.712	.013
	L_GAS_CA	.771	.375	.261	2.058	.052

a. Dependent Variable: OR_AL_PC

**Lake Oroville Models – Actual vs. Predictive Attendance Values
(% Difference)**

MODEL	Low Lake Levels (< 800 feet)	Moderate Lake Levels (800 – 850 feet)	High Lake Levels (> 850 feet)	Overall
Preferred Model	1.00%	-1.29%	-0.49%	-0.34%
Alternative Model 1	0.19%	-2.91%	-1.67%	-1.58%
Alternative Model 2	-1.02%	-2.41%	-0.98%	-1.54%
Alternative Model 3	0.07%	-2.83%	-1.63%	-1.57%
Alternative Model 4	-0.39%	-4.16%	-2.48%	-2.48%
Base Model	0.54%	-5.17%	-1.21%	-2.19%

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APPENDIX B

ATTACHMENT G – FOREBAY RECREATION MODELS

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FOREBAY "PREFERRED" MODEL

Variables Entered/Removed^d

Model	Variables Entered	Variables Removed	Method
1	IVF_LGYR, L_ORO_E ^a L, IVF_GAS	.	Enter

a. All requested variables entered.

b. Dependent Variable: FRBAY_ATT_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.812 ^a	.659	.613	.0597840

a. Predictors: (Constant), IVF_LGYR, L_ORO_EL, IVF_GAS

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.152	3	.051	14.190	.000 ^a
	Residual	.079	22	.004		
	Total	.231	25			

a. Predictors: (Constant), IVF_LGYR, L_ORO_EL, IVF_GAS

b. Dependent Variable: FRBAY_ATT_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.127	1.421		2.201	.039
	L_ORO_EL	-.424	.212	-.259	-2.000	.058
	IVF_GAS	.163	.026	1.261	6.191	.000
	IVF_LGYR	-9.49E-02	.016	-1.231	-6.124	.000

a. Dependent Variable: FRBAY_ATT_PC

Alternative 1

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	IVF_YEAR, L_ORO_E L, L_GAS_C A, DV_7980, L_YEAR	.	Enter

- a. All requested variables entered.
b. Dependent Variable: FRBAY_ATT_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.878 ^a	.770	.713	.0514654

- a. Predictors: (Constant), IVF_YEAR, L_ORO_EL, L_GAS_CA, DV_7980, L_YEAR

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.178	5	.036	13.426	.000 ^a
	Residual	.053	20	.003		
	Total	.231	25			

- a. Predictors: (Constant), IVF_YEAR, L_ORO_EL, L_GAS_CA, DV_7980, L_YEAR
b. Dependent Variable: FRBAY_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.308	1.231		1.875	.075
	L_YEAR	7.340E-02	.034	.655	2.147	.044
	L_ORO_EL	-.329	.185	-.201	-1.781	.090
	L_GAS_CA	.190	.072	.376	2.627	.016
	DV_7980	.158	.050	.706	3.166	.005
	IVF_YEAR	-1.55E-02	.003	-1.477	-4.920	.000

- a. Dependent Variable: FRBAY_PC

Alternative 2

Variables Entered/Removed^d

Model	Variables Entered	Variables Removed	Method
1	IVF_YEAR, L_ORO_E L, L_GAS_C A, DV_7980 ^a	.	Enter

a. All requested variables entered.

b. Dependent Variable: FRBAY_ATT_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.847 ^a	.718	.664	.0557111

a. Predictors: (Constant), IVF_YEAR, L_ORO_EL, L_GAS_CA, DV_7980

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.166	4	.041	13.339	.000 ^a
	Residual	.065	21	.003		
	Total	.231	25			

a. Predictors: (Constant), IVF_YEAR, L_ORO_EL, L_GAS_CA, DV_7980

b. Dependent Variable: FRBAY_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.478	1.330		1.863	.076
	L_ORO_EL	-.341	.200	-.208	-1.707	.103
	L_GAS_CA	.174	.078	.344	2.234	.037
	DV_7980	.205	.049	.915	4.212	.000
	IVF_YEAR	-1.11E-02	.003	-1.061	-4.277	.000

a. Dependent Variable: FRBAY_PC

Alternative 3

Variables Entered/Removed^d

Model	Variables Entered	Variables Removed	Method
1	IVF_GAS, L_ORO_EL, IVF_YEAR, L_YEAR ^a	.	Enter

- a. All requested variables entered.
b. Dependent Variable: FRBAY_ATT_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.884 ^a	.782	.740	.0490016

- a. Predictors: (Constant), IVF_GAS, L_ORO_EL, IVF_YEAR, L_YEAR

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.180	4	.045	18.778	.000 ^a
	Residual	.050	21	.002		
	Total	.231	25			

- a. Predictors: (Constant), IVF_GAS, L_ORO_EL, IVF_YEAR, L_YEAR
b. Dependent Variable: FRBAY_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.292	1.157		1.982	.061
	L_YEAR	7.423E-02	.031	.663	2.402	.026
	L_ORO_EL	-.313	.172	-.191	-1.817	.083
	IVF_YEAR	-1.61E-02	.003	-1.537	-5.898	.000
	IVF_GAS	9.819E-02	.017	.760	5.636	.000

- a. Dependent Variable: FRBAY_PC

**Forebay Model – Actual vs. Predictive Attendance Values
(% Difference)**

MODEL	Low Lake Levels (< 800 feet)	Moderate Lake Levels (800 – 850 feet)	High Lake Levels (> 850 feet)	Overall
Preferred Model	-1.81%	-16.27%	1.84%	-6.25%
Alternative Model 1	-1.54%	-11.02%	3.00%	-3.79%
Alternative Model 2	-0.52%	-15.81%	5.61%	-4.51%
Alternative Model 3	-1.60%	-10.65%	3.00%	-3.66%

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APPENDIX B

ATTACHMENT H – OROVILLE MONTHLY MODEL RESULTS

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OROVILLE "PREFERRED" MONTHLY MODEL

Variables Entered/Removed^d

Model	Variables Entered	Variables Removed	Method
1	DV_SEP, DV_AUG, DV_JUNE, L_ORO_EL	.	Enter

a. All requested variables entered.

b. Dependent Variable: ORO_M_PC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.874 ^a	.765	.715	.02949

a. Predictors: (Constant), DV_SEP, DV_AUG, DV_JUNE, L_ORO_EL

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.054	4	.013	15.433	.000 ^a
	Residual	.017	19	.001		
	Total	.070	23			

a. Predictors: (Constant), DV_SEP, DV_AUG, DV_JUNE, L_ORO_EL

b. Dependent Variable: ORO_M_PC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-3.675	1.241		-2.961	.008
	L_ORO_EL	.576	.183	.440	3.139	.005
	DV_JUNE	-9.55E-02	.017	-.765	-5.493	.000
	DV_AUG	-2.74E-02	.018	-.219	-1.533	.142
	DV_SEP	-8.95E-02	.019	-.717	-4.726	.000

a. Dependent Variable: ORO_M_PC

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